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AND

BOSTON JOURNAL OF CHEMISTRY.

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INDEX TO VOLUME XXI.

Articles marked with (*) are illustrated.

PAGE

A Doctor who could Shoot 108
Accident, A Curious 174
Acid Boracic in Fetid Perspirations 48
Acne Punctata and Kindred Affections 167
Air, The Purity of Mid-Atlantic 31
Alkali 20
Alloy which Expands on Cooling 68
Alumina, Phosphorescence of 36
Ambrette 162
American Association at New York, The 132
America, Early Inhabitants of 25
American Psychical Society 48
Anæsthetics 48
Ancient Metal-Workers in the United States 170
Anglomania, A New Form of 168
Aniline Colors, The 173
Aniline Dyes in the East 21
*Animals, Self-Mutilation of 126
Apartment Houses 117
Arbor-Vita in Phosphuria 32
*Archæological Discoveries, Recent 156
Arlt, Professor 168
Arsenic and Antimony, Separation of 98
Arsenic Complexion Wafers 87
Arsenic Eating 78
Arsenic, The Distribution of 97
Artificial Light, Chemistry of 175
Artificial Limbs, The Archæology of 48
*Art, Prehistoric 119
Astrology in Shakespeare 177
Astronomical Phenomena for January 11
" " " February 26
" " " March 43
" " " April 58
" " " May 73
" " " June 88
" " " July 102
" " " August 119
" " " September 135
" " " October 150
" " " November 164
" " " December 179
Astronomy, Shakespeare's 117
*Atmospheric Phenomena, Some Remarkable 51
Atoms 112
*Autumn Leaves: their Color-Changes and their Fall 34

Bacteria: Classification and Relation to Higher Fungi 43
Baird, Prof. Spencer F. 149
Baked Beans 86
Baking Powders 23
Balances, The Adjustment of Delicate 130
*Balloon, A Miniature 118
Barometer and the Winds, The 120
Battery Residues 54
Begonias 162
Bell Telephone 41
Berlin Letter 180
Bishop, The Mind-Reader 9
Biting off Threads 8
Blackboard Paint 68
Blackberry Vines 148
Blue Hill Meteorological Observatory 10
Bomb Test, A 85
Boots, To Cure Creaking 70
Bottle, The Magic 114
*Boussingault 109
Boy, Physical and Mental Development in the Average 105
Brake, The Anchor 113
British Association at Manchester, The 156
Building in Tunis 113
Burns, Acid 20
Butter and Oleomargarine 148
Butter-Testing 74
Butter, Test for Adulterated 27

Camera, Power of the 144
Carbonic Acid Gas, Solid 54
Carbonic Dioxide in the Arts 112
Carbonic Dioxide Solidified 158
Carbons, Electric 83
Carboniferous Era, The 18
Carpet Beetle, The 99
Cast Steel, The Carbon in 146
Cattle, Origin of 69
Centigrade Degrees, To Reduce to Fahrenheit 20
Centenarians, Collective Investigation of 47
Cement for Fastening Metallic Letters on Glass 160
Chamois Skins, Old 70

PAGE

Charcoal for Pigs 20
Chemistry, A New Basis for 149
Chemistry, Who should Study 164
Chloroforming Persons while Asleep 167
Chlorine, The Commercial Manufacture of 130
Chlorine without Heat, Preparation of 160
Chrotograph, The 184
Cinerarias 161
City Houses 57
*Civet, The 103
Clark, Alvan 149
Coal Product of 1886 130
Coal Tar 159
Coating for Pipes, Non-Conducting 68
Cocoanuts 100
Cod Liver Oil, Administration of 16
Coke Dust, Utilization of 130
Cold, The 25
Color-Blindness, Facts Concerning 12
Constipation, Chronic 31
Cooking-Stove, Chemistry of 85
Copper and Nickel, A New Process for Coloring 129
Cotton 100
Cotton-Seed Oil in Olive Oil 68
Cremation 78
Cremation in Holland 16
Croquet 8
Crown Glass 159
Crystals, Peculiar 67
Cultivated Plants, The History of 22
Curious Facts about Common Animals 19
Cutting Glass Tubes, A Sure Method of 22
Cycling, The Hygiene of 30

*Dalton, John 63
Dangerous Ware 24
"Dead Space" in Chemical Re-actions 41
Death from Anæsthetics in England 16
Death from Sting of a Wasp 16
Death Penalty, Best Method of Inflicting 57
Death-Rate of the Earth, The 168
Dentistry, Etruscan 123
Deserted Farms in England 176
Devitalized Oxygen 117
Digestion of Starch 30
Distilled Water in Eye Lotions 76
Distillery Waste for Feeding Cows 117
*Drowning, A New Cause of Death by 152
Dr. Roscoe's Inaugural Address 163
Dry-Plate Negative, The Largest 9
Early Rising, The Art of 8
Earthquakes, The Magnetic Effect of 144
Earthquake in Arizona 87
Earthquake in France, The 57, 58
Edible Bird's Nest, Examination of 8
Eggs, To keep 86
Egg Color, Artificial 133
Egg, The Humorous 185
Electricity, A New Application of 174
Electricity: Application to Weaving 54
Electrical Conductivity 20
Electric Lamp 53
*Electric Motor, An Early Form of 160
Electrotyping Solution, A New 22
Elements, The Four 144
Emery-Cloth Files 160
England, Agricultural Position of 7
Engine, Gigantic Cotton-Mill 130
Engineer, An Intelligent 130
Evolution of Fruits 24
Exercise and Recuperation 61
Expanding Cement to stop Leaks in Mines 68
Experiments, Easy Chemical 114
Expert Testimony, Fees for 31
Explosive, A Curious 83

Fainting and Syncope 184
Farmhouse Cellar a Breeder of Diseases, The 116
Felon, To Abort a 48
*Fern, The Climbing 19
Field Geology 64, 80, 94, 109
Filters 98
Filter Funnels 98
Filter-Paper, Resistant 5
Fires from Steam-Pipes 74, 89
Flame, The Ghastly 114
Flat Lens, A 158
Flea, Lock and Key for a 146
Flight, A Long 144
*Flint-Mines, Prehistoric 134
Floor Paint, A Cheap 176
Flowers, Nectar Glands of 128

PAGE

Flowers, Preserving 70
Flowers, To Preserve 116
*Fluorine, Isolation of 5
Freckles, Treatment of 16
Free Iodine, Natural 172

Galioscope, The 170
Gas-Holder, A Cheap 146
Gas-Lamp, An Incandescent 53
Gas-Meters, Danger from 130
Genesis of the Elements 9, 41
Ghosts, What of 1
Glass, Colored 113
Gleanings 8, 24, 40, 70, 100, 176
Gold Alloys, Effects of Impurities in 130
Gold, The Atomic Weight of 144
Gun, The Maxim 6
Guns, Great 130

Habit, Laws of 36
Hair, Care of the 125
Hand-Grenades 113
Harness Blacking 40
Harnish or Varnish or Reviver 70
Heat Holidays 16
Heat Measurer, A New 146
High Altitude: Effects upon the Pulse 29
High Life 24
Honey 24
Honey Plant, A New 176
Honey, Poisonous 100
Horses 70
Hot-Beds 24, 70
*House-Fly, Supposed Parasite of 27
Household Hints 8, 70, 86, 132, 176
Housekeeper as a Chemist, The 7
How Argo measured the Power of Steam 22
How Far can One See? 11
How to Cut a Bottle 98
How the Sun puts out the Fire 53
Human Brain and Mental Phenomena, Some Facts concerning 28, 45, 60, 75
Humming-Bird, The Tongue of the 128
Hunger 45
*Hydraulic Lift for Canal Boats, A 21
*Hydrogen Apparatus, A Simple Sulphuretted ... 98
Hydrogen Compounds, Liquefaction and Solidification of 128
Hygienic Errors 60

Ice, Impure 71
Ice-Making, Artificial 67
Ice-Palaces 37
Ice-Poultice 168
Icicle: How Formed 42
Incubator, A Novel 148
Indians, Effect of Change of Climate upon 77
Indian Pestle, Unusual Form of 163
Industrial Memoranda 6, 22, 54, 130, 146, 174
Infant Dietetics 15
Ink, A Good 160
Ink, Magic 85
Insects, To Destroy 162
Investigators, Baffled 133
*Iron Casting, A Novel Process of 112
Iron Now and Then 6
Iron, Transparent Molten 130
Isomeric Organic Compounds, Solubility of 174
Ivy Poisoning 89

Labels 16
Label Paste 98
Laboratory Floors, Composition for 160
Laboratory, In a 134
Laboratory Notes 98
Land in Germany, Division of 40
Landscapes, Chemical 114
Laundry, Chemistry of the 55
Lavoisier, Antoine Laurent 141
Lavoisier, Death of 127
Leather, Cement for 160
Lecture Experiments, Thermometer for 54
Leeches of Japan 139
Left-Handedness, Hereditary 41
Lemons, Keeping 86
Letters sent in Cannon-Balls 22
Lick Telescope, Glass Disk for 163
Lighting Apparatus, Exhibition of 53
*Lightning-Flash, Photograph of a 159
Lightning-Stroke, Effects of 163
Lilies 162
Lime-Water, Remarkable Specific Gravity of 98

PAGE

Linen, To Whiten ... 176
Liquids, Solidification of, by Pressure ... 172
Literary Notes, 12, 28, 44, 59, 74, 89, 104, 121, 136, 151, 165, 181
Liver, The Functions of the ... 78
Locomotive Tests ... 174
Loons' Teeth ... 27

Machine, New Dynamo ... 5
*Magic Compass, A ... 68
Magnet ... 53
Magnet: Use in Paper Manufacture ... 174
*Magnetic Chariots of China and Japan ... 17
Main Railway of Siberia, The ... 114
Making Hard Wood out of Soft ... 54
Manganese, Metallic ... 129
Marine Purification ... 78
Meat, To Select ... 176
Medical Congress, The Ninth International ... 153
Medical Memoranda ... 16, 32, 48, 78, 124, 168, 184
Medicine a Profession, not a Trade ... 13
Medicine, Explosive ... 29
Medicine, How to take ... 15
Metal Industry, A New ... 160
Metals, Expansion and Contraction of ... 6
Metals and Metalloids ... 34
Metastatic Inflammation of the Brain cured by Simple Remedies ... 138
Metcalf, Theo ... 71
Meteor, An Ancient ... 83
Meteor, A Large ... 163
Meteorology for November, 1886, with Review of Past Autumn ... 11
Meteorology for December, 1886, with Partial Review of Year ... 26
Meteorology for January, 1887 ... 43
" " February, 1887, with Review of Past Winter ... 58
Meteorology for March, 1887 ... 72
" " April, 1887 ... 88
" " May, 1887, with Review of Past Spring ... 102
Meteorology for June, 1887 ... 120
" " July, 1887 ... 136
" " August, 1887, with Review of Past Summer ... 151
Meteorology for September, 1887 ... 165
" " October, 1887 ... 181
Meteorology, Popular Errors in ... 65
Meteorological Science, International Co-operation in ... 49
Mildew ... 86
*Milk Tester, A Centrifugal ... 23
Minerals, Cement for ... 114
Minerals and Metals, Ancient ... 36
Mirage, A Remarkable ... 67
*Mirror, A Magic ... 150
Monkey-Wrench, The ... 174
Monthly Summary of Medical Progress: January, 14
" " " " February, 29
" " " " March, ... 46
" " " " April, ... 61
" " " " May, ... 76
" " " " June,..... 91
" " " " July, ... 106
" " " " August, .. 123
" " " " Sept'mb'r, 137
" " " " October,.. 154
" " " " Novemb'r, 166
" " " " December, 183
Moon, Benefits of the ... 144
Mucilage, The Best Way to Keep ... 70
Musbrooms, Nutritive Value of ... 70

Natural Gas ... 133
Natural History Notes ... 3, 18, 52, 65, 82, 120
Niagara Gorge, The Old ... 27
Niagara in Winter ... 82
Nickel as a Material for Dishes and Crucibles ... 37
Nile, The Valley of the ... 67
Nitrous Oxide, Controlling Patients under the Influence of ... 107
Nomenclature, Errors of ... 101
Nugget, A Large ... 172

Oak, How to Darken ... 6
Ocean Travel, Limit of Speed in ... 25
Ohm, Changes in the ... 172
Oil Meal for Cattle ... 24
Oil Stains ... 159
*Oil-Stove, A Simple ... 129
Old Oak, The Color of ... 8
*Old Perfumer, A Famous ... 79
Oleomargarine under the New Law ... 70
Olfactory Acuteness ... 107
*Optical Illusions ... 101
Osar, Notes on the ... 144
Overwork in Schools ... 133
Oxygen, New Mode of Preparing ... 98
Oxygen in Silver, On the Presence of ... 20
Ozone ... 20, 83

Pain and its Uses ... 75
Paper, Colored ... 172

PAGE

Papier-Maché, To make ... 159
Paris Letter ... 38, 73, 103, 143, 179
*Pasteur, Louis ... 135
Patent Medicines ... 182
Peach, Origin of the ... 161
Pearl, The Southern Cross ... 172
Pearls, Vegetable ... 148
Pencils for Writing on Glass, Porcelain, etc. ... 160
Pendulum, A Perfect ... 67
Peroxide of Hydrogen as a Bleaching Agent ... 113
Photographs in Natural Colors ... 133
*Photograph of a Mirage ... 84
*Photography, An Amusing Application of ... 145
*Photography at Long Distances ... 5
* " Celestial ... 118
" " Delicate ... 54
* " Nocturnal ... 37
" " Orthochromatic ... 57
Phthisis, Influence of Altitude on ... 139
*Physical Experiments, Simple ... 51
Physiological Clothing ... 16
Pine, The Long-leaf ... 127
Plant Growth, Mysteries of 39, 55, 69, 85, 99, 115, 131, 147, 160, 175
Plant of Great Antiquity, A ... 56
Plumbers, Use of Lead by ... 6
Pocket Accumulator, How to make a ... 97
Pocket Heliograph, A ... 22
Poisoning by Poison Oak and Poison Vine ... 77
Poisoning by Squills ... 148
Poisonous Chemicals, Antidotes for ... 53
Positive Copies of Drawings ... 68
Possibilities of the Future ... 87, 101
Potassium Permanganate in Burns and Frost-bites, 31
Postal-Cards ... 130
Potatoes ... 24
Potato, What of the ... 155
Practical Recipes ... 68, 114
Pulmonary Diseases in Germany, Exemption from, 48
Pumps, Capacity of ... 174
Putty, Hard ... 114
Pyromagnetic Motor ... 149

Quackery, What is ... 16
Questions and Answers. 11, 28, 44, 59, 74, 89, 104, 121, 136, 151, 165, 181

Railroad Building in 1887 ... 174
Railroad Cars, Electric Lighting of ... 54
Railroad Cars, Heating of ... 57
Railroad Notes ... 54, 113, 174
*Railroads, Oriental ... 141
Railroad Surgery ... 168
Railway Lubrication ... 114
Railways, Persian ... 114
Railway Speed, High Rate of ... 177
Raspberry, The ... 176
Rattlesnake Bites, Remedies for ... 18
Reverse Filtration, Simple Arrangement for ... 98
Revolver Cure, The ... 107
Rifle Barrels ... 98
River Terraces, Formation of ... 171
Rocks at Niagara, Fall of ... 44
Roman Fever ... 184
Rome, Electric Lighting of ... 54
Ropes, To Preserve ... 146
Roses, Soot for ... 70
Rotundity of the Earth ... 67
Round Forging, A New Process of ... 22
Rubber Apparatus, The Means of Preventing the Deterioration of ... 31

Saccharine, The Inventor of ... 53
Salicylic Acid ... 168
Salicylic Acid in Dry Rot ... 172
Salts, Complex Inorganic ... 5
Salt Mountain of Palestine, The ... 54
Sanitary Science and Domestic Architecture ... 166, 182
Sanitary Water Analysis, Significance of ... 173
Scarlet Fever from Cows ... 133
*Schoele, The Centenary of ... 17
Schoolboy, A Scientific ... 86
School Children, The Necessity of Exercise for ... 123
Science and Theology: How they Differ ... 4
Scientific Brevities, 4, 20, 36, 53, 67, 83, 128, 144, 158, 172
Scientific Errors by Novelists ... 57
*Scientific Experiments, Simple ... 80, 155, 169
*Scientific Recreations ... 9, 33, 94
Sea-sickness, An Easy Method of Preventing ... 168
Sea-Weed, Value of ... 174
Selected Recipes ... 24, 70
Serpent Mound Park, The Purchase of the ... 128
Sheep Skin with Wool on, To Cure a ... 100
Sheet, A Movable, for the Sick ... 78
Shellac Varnish, A Clear ... 160
*Signalling Apparatus, A Portable ... 67
Silicon, The Atomic Weight of ... 158
Silk Ribbons, To Silver ... 160
Silver Molecule, Size of the ... 158
Silver Ore in Mexico, Reducing ... 38
Skeleton Industry in France ... 139
Skin, The Temperature of the ... 139
"Sleetover" ... 177
Slimy Precipitates, Separation of ... 5

PAGE

Slow Mental Development as seen in Dull Boys ... 90
Snails, The Strength of ... 66
Snakes, Glass ... 177
Snow ... 18
Soda Paper, Uses of ... 5
Sodium, Cheap ... 20
Sodium and Potassium, Cheap Manufacture of ... 98
Soil, Cultivating Frozen ... 100
Soldering Flux ... 68
Solution ... 71
Some Alleged New Elements ... 158
Sparrow, The English ... 23
Spiders and Forests ... 8
Spontaneous Combustion ... 115
Spring, A Remarkable ... 128
State Interference ... 149
Statue, Largest, in the World ... 179
Steam, Pressure and Volume of ... 172
Steatite for Walls, Pulverized ... 6
Stethoscopes, An Improvement in ... 92
Stonework, A New Method of Cleaning ... 159
Stray Lunagraphs ... 111
Streams, Flow of ... 83
Strikes and The Industrial Organization ... 93
Styptic Paper ... 77
Sub-Chloride of Silver ... 4
Substitute for Sealed Tubes for Heating under Pressure, A Convenient ... 84
"Sugarine" Process ... 71
Sulphate of Lime, Solubility of, in Hot Water ... 101
Sulphuretted Hydrogen Enemata in Consumption, 87
Sun, Total Eclipse of ... 101, 133
Superstitions, Popular Scientific ... 88
Supposed Parasite of House-Fly ... 18

Tanning Leather, A New Coal Product for ... 37
Tea and Coffee, A Word upon ... 137
Tea-Kettle, Science of the ... 114
Tea Poisoning ... 169
Telegraph Wire, A Novel Substitute for ... 36
Telegraph-Wire Nuisance ... 9
Telegraphy Without Wires ... 25
Tempering Springs ... 68
Tempering Steel with Electricity ... 159
Thermometer Tubes ... 146
Thore's New Force ... 117
Timepiece the Size of a Pea, A ... 146
Tin, A Peculiar Property of ... 146
Tobacco in Great Britain ... 176
Tobacco Waste ... 160
To make Paper adhere to Metals ... 160
Toilet Powders ... 140
Total Solar Eclipse ... 101, 133
Train Speeds in Prussia, Taking ... 37
Trains, Speed of ... 114
Tramways, Electricity of ... 129
*Travelling Bridge, A ... 6
Trees, Native and Foreign ... 146
Trees, Protection for ... 24
Trench Fire Apparatus ... 174
Tungsten ... 72
Tungsten Steel ... 104

Vanishing Spoons ... 85
Vegetable Remedies, So-called Pure ... 47
Vineyard for Sale, A ... 116
Volapük, The World-Language ... 158
Volcanic Ashes, Silver in ... 53
Vortex Smoke Rings ... 85

Wallace, Dr. Alfred R ... 25
Waltham Watch Factory, Reputation of ... 54
Wasp, A Wise ... 66
Waste of Steam in Whistling ... 22
Waste-Pipes, Clearing of ... 8
Water Analysis, Permanganate of Potassium in ... 149
Water as a Diuretic ... 48
Water, Biological Analysis of ... 149
Water-Light, A ... 162
Water in Furnaces, Evaporation of ... 39
Water-Power, A Remarkable ... 174
*Water Pump for the Laboratory, A ... 83
Wax, Grafting ... 176
Weather Lunacies ... 96, 111
Weather Prognosticators ... 144
What Chemistry has done for the Arts ... 145
Wild Plants, Poisonous ... 148
Wilder, Marshall P ... 41
Winter Gardens, Hints for ... 162
Wires, Underground ... 54
Wood, Ignition of, by Steam Heat ... 57
Wooden Tools, How to Treat ... 6
Wool Clip of 1886, The ... 40
Worm and Turf ... 40
Wound in the Head, A Remarkable Recovery from ... 62
Writing-Desk, Chemistry of the ... 125
Wrought-Iron, How to Soften ... 6

Youmans, Prof. Edward L ... 41
Yttrium, Elementary Components of ... 71

Zinc-Work, Painting of ... 6

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CONTENTS.

FAMILIAR SCIENCE. — What of Ghosts? 1
Natural History Notes 3
How Science and Theology Differ 4
Scientific Brevities 4

PRACTICAL CHEMISTRY AND THE ARTS. — Photography at Long Distances 5
The Isolation of Fluorine 5
A Travelling Bridge 6
Industrial Memoranda 6

HOME, FARM, AND GARDEN. — The Housekeeper as a Chemist 7
The Agricultural Position of England 7
Clearing Waste-Pipes 8
Croquet 8
Household Hints 8
Gleanings 8

EDITORIAL. — Scientific Recreations 9
The Blue-Hill Meteorological Observatory 10
Astronomical Phenomena for January, 1887 11
Meteorology for November, 1886, with Review of the Past Autumn 11
How Far can One See? 11
Questions and Answers 11
Literary Notes 11

MEDICINE AND PHARMACY. — Some Facts concerning Color-Blindness 12
Medicine a Profession, not a Trade 13
Electricity and Hygiene 14
Monthly Summary of Medical Progress 14
How to take Medicine 15
Infant Dietetics 15
Medical Memoranda 16
"Humors" 16

PUBLISHERS' COLUMN 16

Familiar Science.

WHAT OF GHOSTS?

BY THE SENIOR EDITOR.

THE word "ghost," as popularly understood, has a restricted meaning, and is applied only to apparitions, or incorporeal beings, who, during historic times, have been alleged to appear in certain dwellings, in highways, byways, or in lonely, unfrequented places. The word, in its generic sense, means the soul of man, or the spirit of man, the soul of a deceased person, a spirit separate from the body. The third person of the Trinity, designated as the "Holy Ghost," holds a conspicuous place in Christian doctrine and literature, and is assumed to be a distinct entity. With the prevailing notion of the nature of ghosts, it is certain that the "Holy Ghost," as a personality, does not become clear to the apprehensions of Christian believers generally. The third person of the Trinity, notwithstanding the positive way in which personality is asserted by the sacred writers, appears shadowy or vague in contrast to ideal conceptions of God and the real Christ. A vast majority of Christian believers have little difficulty in bringing before their imaginations distinct notions of a personal being in God the Father. The image assumes, of course, the human form, but is far greater and more majestic.

The Christ, as a real personage, fully meets all terrestrial, sensual conceptions, all longings, all needs. "He was made flesh, and dwelt amongst us." All ideal conceptions, however, of the third person of the Trinity, are of a pleasing and assuring nature to Christian believers. The office and duties of this immaterial, divine essence or spiritual emanation, according to the sacred writers, deeply concern believers, as they involve that of "comforter," or messenger of good between human souls and the divine Father.

In contrast, we have to bring to view the extreme terror, the deep aversion, inspired among all classes by ghostly apparitions during the fifteen centuries between the fourth and the nineteenth of the Christian era. This period of time is specially mentioned, because there is no evidence to prove that ghostly interferences were infrequent, unexpected, or terror-inspiring, during the time of Christ and the apostles, or the three or four following centuries, when the Christian faith was zealously promulgated by the early Fathers of the Church. It is clearly understood by all students of sacred history, that the Divine Master and his followers had much to do with ghostly proceedings, and that spiritual existences were distinctly recognized by him; indeed, they form the basis upon which rests the superstructure of the Christian faith. All readers of the New Testament are familiar with occurrences as "occult," "strange," "incredible," "impossible," as are related by the most credulous ghost-seers of the present epoch.

During the early centuries, when ghostly interferences were common in terrestrial concerns, and when they were understood and believed in not only by the disciples of the new faith, but by the great mass of the Jews and pagans in the Roman Empire, it does not appear that the "manifestations" excited any special surprise or terror. It is true, that a considerable part of the occult phenomena of the times was viewed as the work of devils, or attributed to diabolical origin; but only in the instances of individual obsession, and a few others recorded in the New Testament, do we find that serious personal injuries or inconveniences resulted from ghostly agencies. If the Master had not on more than one occasion positively asserted the demoniacal sources of the maladies which came under his observation, we should reject the diagnosis of the cases as rendered by those who directed his attention to them. Christian theology has for eighteen hundred years recognized the existence of a class of invisible beings called "fallen spirits," "evil spirits," or evil ghosts; but only one branch of the Church, the Papal, retains apparently a practical belief in their present terrestrial activity. The belief in devils, demons, etc., is clear and pronounced in the Papal Church, and that organization also charges a large number of the evil occurrences which disturb the world to the direct influence of devils, — devils in the flesh, and "devils in the air." The divines, theologians, commentators, etc., who have assumed ecclesiastical authority on the basis of Luther's reforms, do not seem to possess very clear notions of the nature or agency of devils, although probably no one of them was ignorant of the historical statement, that the great preacher and reformer hurled an inkstand at the Devil's head as he came into his presence.

During the fifteen centuries between the fourth and nineteenth, ghosts greatly disturbed the world, and awakened profound terror. Before the dawn of modern science, which came to earth's suffering inhabitants as an angel of light, superstition in every conceivable form held individuals and communities in its iron grasp. Ghostly superstitions were more cruel and unsparing than most other forms; and, when the evil buds of fear and hate blossomed into the witchcraft delusions, the climax of misfortune was reached.

Looking back upon these remarkable outbreaks of fanaticism, and having in view the peculiar religious influences which controlled the public mind, the transactions do not seem in any degree incomprehensible, or not what might have been expected. With the light we now have, no one can read the statements and commands concerning witches found in the Hebrew Scriptures, without feeling that the acts were fairly based upon instructions therein contained. Our fathers held the Book as an infallible guide, and its commands were not to be disregarded. "Thou shalt not suffer a witch to live." This was enough. The command implied that witches *did* live; and when they discovered, in connection with individuals, any occult proceedings or conduct which their scanty knowledge could not explain, it was natural that it should be regarded as due to witchcraft. The wonder is, how it was possible, in such an age, and under such unfavorable conditions of knowledge, the illusion could have been so readily and effectively stamped out. It was painful to live in that stern age of religious intolerance, when every life was forced to conform, outwardly at least, to the requirements and commands of an ancient religious code, not well understood, and uniformly misinterpreted.

Within the period of the past half-century events of vast importance have transpired, and changes in human thought, conduct, and belief have been rapid and revolutionary. The

new has supplanted the old; and we are now living under conditions so entirely dissimilar, that we seem to tread a new earth, with the old heavens hanging over us. Striking as have been the physical changes wrought by man, the most important are interwoven into his social and psychical nature. The better interpretation of nature and her laws has revealed the deformities and evils of old beliefs, and rendered human existence more tolerable and desirable.

Ghosts, real or imaginary, are no longer objects of fear; indeed, the strange fact confronts us, that they are viewed with favor, and their visits welcomed by thousands in all civilized lands. The presence of apparitions, whether coming to view in social circles or in "haunted houses," excites only interest and curiosity. There are those who claim to have as many acquaintances and friends in ghostland, with whom they are in frequent communication, as they have in terrestrial life, and those to whom I refer are not confined to the unlearned classes.

Nothing in history or in human experience is more remarkable than the fact that within the brief period of forty years a body of intelligent men and women, numbering many millions, have been profoundly impressed with the belief that direct inter-communication is established between the living and the dead. The method of ghostly telephony was discovered by Isaac Post of Hydesville, N.Y., in December, 1847; and, if the phenomena to which the discovery is applicable rest on a basis of truth, the importance of the inventions and the results attained by Bell, Gray, Edison, and others, in terrestrial telephony, are dwarfed in comparison.

Post's discovery was made in connection with the widely known house-disturbances which occurred in the Fox family at Hydesville. One of the prominent forms of these disturbances were sharp, explosive raps, like those which come from statical electrical machines when discharges occur. The raps came upon the walls, ceilings, and floors of the rooms, and were produced by undiscoverable agents. It was clearly evident, to the family and the many visitors, that there was intelligence connected with the raps; but how to bring the listeners into communication with the disturbers was an unsolved problem. A happy thought entered the mind of Post: he suggested that the alphabet, as found in an old copy of Webster's spelling-book, be employed to draw out intelligent responses from the rappers; and the method was immediately tried, and proved successful. By placing the index finger upon the first letter in the column, and following down to the last, at the same time requesting the ghost to rap when the letters were reached necessary to make up any communication, word responses to questions were readily obtained, and thus carnate man and incarnate spirit, it is alleged, were brought into direct intelligible communication. The dawn of modern spiritism dates from this epoch. Thousands of houses in all countries during the historic centuries have been disturbed with mysterious noises, more or less violent, among which knockings have usually been prominent. No clew to the nature of the phenomena had been secured until the occurrence of the Hydesville rappings and the advent of Post. This invention of a sagacious man was more successful than that of Bell in its earliest stages; but, like that of Bell, it only opened a way for important results, or made it clear that a method of holding communication was possible. It was reserved for other experimenters to perfect methods, or devise new ones better adapted for practical and rapid work. The use of the alphabet no longer continues; slate and letter writing, together with oral messages, and "inspirational speaking" on the part of spirits, have rendered obsolete the original method of Post.

It is indeed remarkable that the phenomena connected with haunted houses have been uniformly the same in every country, among all people, in every age, of which we have any information. If they are the result of collusion or trick, an important fact is brought to view, that the inventive faculty of the mischievous and idle classes of all the ages has run in the same grooves, and produced like results. In modern haunted houses, it is true, we have the persistent ringing of bells, even after the communicating wires are removed, and also we have music produced by unseen hands, on instruments of modern forms; but the whistling and rapping noises, the thumping sounds of violent winds, the slamming of doors, the moving about of articles of furniture and other unfixed objects, the appearance of white, luminous bodies and apparitions in human form, have been the stock phenomena witnessed in haunted houses in ancient and modern times. It would seem reasonable that modern science, with its manifold capabilities for producing cunning and mysterious tricks, should have aided in diversifying the performances (if they are but tricks); but such has not been the case. The old, old phenomena continue, with but slight variations.

The haunted house at Athens which is described by Pliny, afforded phenomena strikingly like what occurred at the house of Rev. Dr. Phelps of Stratford, Conn., thirty-five years ago, and yet the occurrences are separated by a period of eighteen hundred years. The house at Athens was so full of strange noises and unaccountable disturbances that the inmates fled from it in terror; and it remained unoccupied, Pliny informs us, for a long time. The owner was glad to find a purchaser in Athenodorus, a philosopher, at a very low price. But the philosopher and his family were not allowed to remain in quiet: strange noises, as that of the clanging of chains, were heard one night; and, springing from his bed, an apparation in human form appeared, and beckoned him to follow. He did so, and was led to a certain spot of ground near to the house, where the ghost vanished. The public authorities of Athens ordered the place to be examined; and, upon digging into the earth, a skeleton in fetters was discovered. It was removed and buried, and the house was no longer haunted.

The interesting narrative of Dr. Phelps shows that not only the phenomena which were observed at his house, but the apparent cause of its discontinuance, present points of remarkable similarity. The fullest details of these occurrences were given me by the estimable and venerable divine a few years before his death; and those who listened to the recital from his lips were impressed with the sincerity of the narrator, the judicial fairness, and the lucidity of the narrative. Perhaps no instance of alleged house-possession in modern times created more intense interest than this, unless it be that of John Wesley, the founder of Methodism. The Wesley family were disturbed during two months, between Dec. 1, 1716, and Jan. 30, 1717, in which time the house, according to the statements of Wesley and many others, was shaken by winds when all was calm without, disturbed by dismal groanings, loud raps day and night, and a fearful noise over the heads of the family during devotional exercises. The house was much injured by unseen agencies, and investigations made with intelligent vigilance and care failed to detect any cause for the phenomena.

The occurrences at the Phelps mansion in 1850–51 were similar in kind, but extended over a longer period. For several months the dwelling was watched day and night; but the disturbances continued, and all attempts made by different parties to discover the source of the noises utterly failed. It was suggested to the reverend gentleman that the invisible agent or agents be interrogated after Post's method of communicating with ghosts. The persistency which characterized the disturbances, and their annoying character, at last led him to consent to the proposal. A very explicit statement of the method and results of this interview with the ghost was given me by Dr. Phelps, of which I have notes; but there are considerations which prevent them from being made public at the present time. Remarkable as were the house-disturbances, they are of small interest compared with the final chapter in the history of this extraordinary instance of ghost manifestation. The disturbances ceased as soon as the interview was permitted.

There has been considerable controversy, and some denials of statements made, regarding occurrences in the Phelps mansion, which is not strange when the ecclesiastical and theological connections of the eminent divine are considered. The evidence is conclusive, however, that he was never in sounder health, and never were his mental faculties in more accurate equilibrium, than at the time his narrative was given. His high standing during a long and distinguished career as a Christian minister forbids even a suspicion of dishonesty or untruthfulness.

A remarkable instance of house-possession came to my knowledge several years ago, the

incidents of which in many respects are worthy of note. The house is in a suburban town near to the city of Boston, and the family occupying it is highly respectable and intelligent. The disturbances came suddenly, and were to a large extent of the usual character. They continued over a period of five weeks, and were first observed in a chamber once occupied by a son, an officer in the Union army, who was killed in the Battle of the Wilderness in 1862. His sword and uniform were sent home, and placed in drawers in this room; and, in obedience to the instinct of maternal affection, the door was locked, and no one was permitted to occupy the chamber. Extraordinary noises were heard in the room; and, upon going in, it was found to be in a state of great confusion. The drawers were open, and the son's uniform and accoutrements were scattered about upon the floor. The room was again put in order, and, protected by locks, was left for a few hours under supervision, to guard against possible intrusion by servants. Again entering the room, the same disturbances were found to have occurred; and they were repeated after new and complicated locks and window-fastenings had replaced the old ones, after the servants had been sent away, and ultimately they occurred in the presence of the members of the household, and in spite of their attempts at resistance. Disturbances occurred in other parts of the dwelling; and so annoying and alarming did they become, the family was broken up, and the mother left for residence in an adjoining town. The sequel to this brief narrative may be given in a few words. The intruding ghost was interrogated after the manner previously described; and it was stated that the object of the intrusion was to call the attention of the family to some important matters connected with the deceased son's affairs, which matters were promptly attended to, and the disturbances ceased.

It should be stated, that, notwithstanding the prolonged continuance of the phenomena, and the great disturbances produced, but few outside of the family knew any thing of the occurrences, so reluctant were the parties to attract public attention.

In considering alleged instances of ghostly interferences, the easiest and not unusual way to dispose of them is to promptly reject all the assertions, all the statements, of witnesses, and charge every thing to "trick and illusion," two old pack-horses which stand ready saddled and bridled at the doors of many men of popular scientific repute. These serviceable beasts have proved very convenient, and are much used by many clever clergymen and students in science who are asked by the unlearned and perplexed masses to explain some occult phenomena by no means uncommon in modern times.

In his *Essay on Probabilities*, Laplace, the profound mathematician, says, "Any case, however apparently incredible, if it be a *recurrent* case, is as much entitled, under the laws of induction, to a fair valuation as if it had been more probable beforehand." This is manifestly the basis of a true philosophy. Instances of alleged house-possession and apparitions have certainly been "recurrent," and therefore are entitled to a "fair valuation." It is not in accordance with true scientific methods to dismiss recurrent phenomena by a denial of facts, and on the dangerous assumption that such occurrences are "impossible."

Faraday's method was in flagrant violation of the elementary principles of a true philosophy. It was, to "explain what one can, and assert that all the rest is untrue." After this method he "exploded the whole nonsense" (to use his own words) of modern ghost phenomena. His publicly proclaimed methods opened to view the weak side of his nature, and cheapened the estimate in which he was held by many who had bestowed upon him unstinted praise.

In the reports upon haunted houses by the able committee of the British Psychical Society, we have a more reasonable and philosophical treatment of the subject. As respects evidence, which is so often contemptuously disregarded, the committee remark, "We must admit, that, when we have tracked a story to its source, so far from being exaggerated, it is toned down in its features. Amongst educated people the fear of ridicule is pre-potent over even the love of the marvellous and the enjoyment of a good story. After making the largest allowances for possible exaggerations, defects of memory, or the instinctive tendency of the imagination, there remains a mass of evidence regarding haunted houses, we venture to assert, which justifies a steady prosecution of our investigations."

The absurdities of Dr. Carpenter and others, regarding what is designated as "collective hallucinations," "expectancy," etc., are summarily disposed of by the committee. "Neither science nor the common experiences of life has produced any undoubted cases analogous to what has been designated 'collective hallucination;' that is, the observation and identical description by several persons of an appearance having no basis in reality."

A reason is suggested by Professor Barrett why it has been found so difficult to obtain testimony regarding ghost phenomena from educated men. "Most persons," he remarks, "would be of one mind with a gentleman whose story regarding ghost phenomena met with so unsympathetic a reception on its first recital, he would never venture on a second." Not a few men of learning, distinction, and unchallenged probity have been unexpectedly brought into contact with psychical phenomena of a startling nature, and in hastening to impart to other educated men a knowledge of what they had seen, with the view of obtaining assistance in solving the problem, have been met with such an outburst of ridicule or impertinent insinuations, they never venture on a second recital

It may be that the whole mass of evidence regarding haunted houses and ghosts will some day be explicable by causes which all will admit to be natural, but the time will not be hastened by those students in science or theology who uniformly bestow upon the phenomena only derision and contempt.

Time is an important factor in the work of adjusting the mental faculties, when the attention has long been fixed upon unusual and baffling problems. It is of interest, therefore, to learn the views and conclusions of those who have been disturbed by alleged ghostly intrusions after considerable time has elapsed from the date of the occurrences. The disturbances at the house of Dr. Phelps took place in 1850, and the interview with him, to which allusion has been made, was in 1861,—eleven years later. At this time he was past sixty years of age, and in possession of sound physical and mental health.

Dr. Phelps unhesitatingly expressed his firm belief in the extra-mundane nature of the phenomena, characterizing as untenable and puerile the many theories and hypotheses which had been advanced to account for the occurrences, no one meeting the facts in the case. Essentially the same conclusions remain fixed in the minds of the members of the intelligent family residing near Boston, who witnessed the phenomena in their dwelling a dozen years ago. In several other instances of house-possession which have come to my notice, one in Essex County, and another in Middlesex, Mass., the parties or families directly connected hold undoubtingly to the theory that the occurrences were due to the agency of incorporeal beings breaking through from the night side of nature.

The number of instances of alleged ghostly appearances and disturbance which have been brought to my knowledge by parties influenced by a sincere desire to learn the cause and nature of the phenomena, is quite large, and extend over a period of half a century. In reviewing these occurrences late in life, after many years devoted to practical scientific investigation, I fail to find but few which do not present problems and difficulties inexplicable upon any hypothesis based on natural laws as at present understood. No clear and satisfactory light has been secured from any advances made by science, no new pathway has been discovered through the mists which hangs over the border-land between the known and unknown.

NATURAL HISTORY NOTES.

BY DR. S. F. LANDREY.

PART II.

A pugnacious pair of jay-birds built in an apple-tree some thirty feet east of the house. During the brooding-season Mrs. Landrey approached the tree too closely to suit her saucy neighbors. In a noisy, screaming way the blue-jays gave fight and chase. The male pecked her bonnet, and drove her away. One of the older boys thought it was funny; and he, on going under the tree, was given to understand it was disputed ground. I went out; and, making some demonstrations, he started for me: but on taking up a stick, the rogue decamped, not without considerable threatening and chattering back. He wanted the last word; and I

let him have it, to pacify his troubled breast. So pugnacious a neighbor was not very desirable to the family; and as the blue-jays had, for two or three years, driven the peaceable robins from an adjoining fir-tree, my wife's sympathies were with the complaining robins. However, I concluded to keep them on probation a while, and see if they would not change their behavior to the robins, or prove themselves useful in some way. One day I observed the blue-jay picking very earnestly at something on an apple-limb; on climbing the tree, and examining closely, it was discovered that he was ridding the tree of the eggs fastened to the branch by a tent-caterpillar imago. This saved his reputation for usefulness; and I decided that he and the robins were both useful neighbors, and might settle, undisturbed, their own aggrievances. They are all good adjuncts to the apple-orchard and garden, and should be left undisturbed.

Even the much-despised English sparrows, a noisy, dirty, fighting crew, have many useful, redeeming traits of character. They are the best scavengers in existence. Watch them a few hours in any town, and you will confirm the opinion. They destroy cabbage-worms without stint; but farmers object to them on the ground, that, when numerous, they destroy whole fields of grain. I have often wondered where all the wheat comes from on the very farms where these depredations are said to have occurred. These same farmers seldom fail to report an average crop, at least. I saw a squad of them settle on my peas. On seeing them picking at the leaves for a few minutes, I investigated, and found they had destroyed hundreds of small black beetles (*halticas*), and had even torn off the tops of two stalks in their efforts to rid them of the destroying insects. So I voted to give the sparrows a chance for an honest living.

I FOUND, in a small owl's stomach, about two ounces of the shards and remains of beetles. These, many of them, were of the kinds fatal to orchards and forest-trees; proving, thus, that even an insignificant screech-owl is of much value to farmers.

THE common house-wren is also a useful help to farmers and gardeners, in ridding orchards and gardens of insect pests and worms. In nest-building time it is necessary to watch them, for you never know where their fancy will tempt them to build a nest. My good wife one day came to me with a look of surprise, carrying a bucket of water filled with sticks and grass, which she said had come out of the pump. I told her to watch the wren. Not long afterward she saw him fly to the pump-handle, and go in over its top. She chased him out, and kept a cover over the opening for a few days, till he built his nest somewhere else. Like unthinking children, they will commit sinless but unwelcome acts of impropriety in their architectual seasons.

AMONG the evergreens, pine, spruce, fir, and arbor-vitæ trees, also in the apple-trees of my small orchard, last year, were found the nests of Baltimore orioles, robins, sparrows, cross-bills, blue-jays, and blackbirds.

The blackbirds built their nest the year before in a large Norway spruce some distance north of the house, but last year they built in a tall fir within ten feet of the bedroom door. Like civilized people, they proved themselves capable of perfect silence when it was a necessity. No noise did they make to attract the least notice till their brood was hatched and gone. These and the robins made visits every few minutes, on the average, through the entire day, and every day in the week to the garden, during the time of feeding their young. Worms and bugs suffered, and the products of the garden were benefitted by their presence.

A DOZEN or more nicely polished white pebbles, uniform in size, shape, and color, were taken from a loon's gizzard, and presented to me by a friend. They closely resemble artificial teeth in every respect. These questions naturally arise:—

1. Where did the loon get them?

2. They are different from the pebbles usually seen in temperate latitudes: can they, therefore, be strictly of arctic origin?

3. If they have ever been artificial teeth, how came the loon to get possession of such relics?

4. Could they have been of unequal sizes when first swallowed, and, by attrition and muscular motion, reduced to an almost equal size?

5. What particular character of muscle and configuration of gizzard is necessary to reduce to this uniformity a substance resembling amorphous quartz in color, structure, and degree of hardness?

These questions are submitted to the readers of *Popular Science News* for their consideration and determination. We admit having no key to the explanation of these puzzling questions.

TO RATS belongs the credit of introducing trichina first into swine, and then, through the fresh pork and bacon, into human bodies.

In the year 1857 I shot a female rat that came out of my father's corn-crib. The ball passed through the lungs, tearing her body wide open; and, on an examination of the lungs, scarcely a sound spot could be found that was not filled with tubercles, and these with trichinæ in all stages of growth, from inception to maturity. In fact, the entire body, especially the muscles, was a living storehouse of the offensive creatures. Imagine the effect of this in the flesh of a hog that might have eaten it if left above ground. In 1865, on account of some grain-cribs near my dwelling, the house became infested with rats. Seven of these were shot one evening, and incautiously thrown into my hog-pen. A brood-sow ate them all. She was fat when she ate them: in six weeks she was so poor that her bones could well-nigh have been counted through the skin. Of course she died; but her carcass, after its examination, was carefully buried. All parts of the body, especially the intestines, muscles, and lungs, were literally filled with trichinæ. Three cats in succession also succumbed to trichinosis after eating freely of the rats caught under and about the house. The examination of one of these also revealed their presence in the cats' lungs and bodies as the cause of their fatal disorder. A neighbor who killed a hog he could not fatten, brought over a speckled piece of lung and some of the flesh from near the back-bone, as well as a piece of the ham. All were found to be alive with millions of trichinæ; they were literally innumerable. In addition to this, the lungs were full of the *Filaria bronchialiæ* which also infests the human body. From these facts we derive the conclusion, that rats and cats should be kept away from hogs intended for pork. It is certainly criminal, in the light and intelligence of this day, to kill rats and mice, and leave their bodies above ground unburned or unburied.

In 1856 I was eating at a farmer's table. He and his wife had each taken a piece of pork from the plate; in cutting through it, I heard a grating of the knife, as if cutting through a raw turnip. This to me was the sign of measly pork. Knowing that the year before he had burned sixty so-called cholera hogs on his farm, I declined eating any of the pork. I expressed my fears to him and his wife. They laughed at my foolish caution, as they then thought it to be; but they were almost immediately after taken sick, and for years thereafter were doctoring their livers. His hogs had been given free range to an old straw-pile of half-rotted straw, — a regular rat-burrow. I told him, after burning the sixty hogs that died of cholera(!), to shut up his fence, and burn his straw, which, of course, stopped the disease. The hog he had killed was one that had recovered from cholera, as he supposed, but which I knew had *Trichina spiralis* in the flesh. When the straw was dry, the germs were easily conveyed by the nose to the lungs, or more probably to the stomach.

HOW SCIENCE AND THEOLOGY DIFFER.

SCIENCE, in the broadest sense, is simply that which may be verified; but how much of that which theology accepts and goes upon is verifiable by human reason or experience? The kind of evidence which theology accepts, or has accepted in the past, is too much like that which led the old astrologer Nostradamus to predict the end of the world in 1886, because in this year Good Friday falls upon St. George's Day, and Easter upon St. Mark's Day, the very latest date upon which Easter can happen.

Theology, for the most part, adopts the personal point of view, — the point of view of our personal wants, fears, hopes, weaknesses, — and shapes the universe with man as the centre. It has no trouble to believe in miracles, because miracles show the triumph of the personal element over impersonal law. Its strongest hold upon the mind of the race was in the pre-scientific age. It is the daughter of mythology, and has made the relation of the unseen powers to man quite as intimate and personal. It looks upon this little corner of the universe as the special theatre of the celestial powers, — powers to whom it has given the form and attributes of men, and to whom it ascribes curious plans and devices. Its point of view is more helpful and sustaining to the mass of mankind than that of science ever can be, because the mass of mankind are children, and are ruled by their affections and their emotions. Science chills and repels them, because it substitutes a world of force and law for a world of humanistic divinities.

Of all the great historical religions of the world, theology sees but one to be true and of divine origin; all the rest were of human invention, and for the most part mere masses of falsehood and superstition. Science recognizes the religious instinct in man as a permanent part of his nature, and looks upon the great systems of religion — Christianity, Judaism, Buddhism, Mohammedanism, the polytheism of Greece, Rome, and Egypt, etc. — as its legitimate outgrowth and flowering, just as much as the different floras and faunas of the earth are the expression of one principle of organic life. All these religions may be treated as false, or all of them treated as true. What we cannot say, speaking for science, is, that one is true, and all the others are false. To it they are all false with reference to their machinery, but all true with reference to the need to which they administer. — JOHN BURROUGHS *in Popular Science Monthly for December.*

SCIENTIFIC BREVITIES.

SUB-CHLORIDE OF SILVER. — It has commonly been supposed, that, when chloride of silver is blackened by light, there is produced a lower chloride, the so-called sub-chloride of silver, and, as a second step, metallic silver. Spencer B. Newbury (*American Chemical Journal*), however, after making experiments tending to test the accuracy of this assumption, has arrived at the conclusion that

no sub-chloride, but only metallic silver, is formed under the circumstances. In fact, he demonstrates conclusively that none of the previous observers who have described sub-chloride of silver have had this substance under their hands. It is, therefore, highly probable that the compound has no existence at all.

Complex Inorganic Salts. — A salt recently studied by Dr. Wolcott Gibbs has the remarkable symbol: —

$$24WO_3 . As_2O_5 . 3[As_2O_5 . 2PtCl_2]12Pt(NH_3)_4O + 60Aq.$$

Another the formula: —

$$22WO_3 . 3As_2O_5 . 3[As_2O_5 . 2PtO]6Pt(NH_3)_4O + 40Aq.$$

A beautiful pale-green molybdenum compound has the formula: —

$$12MoO_3 . As_2O_5[As_2O_5 . 2PtO]2Pt(NH_3)_4O + 27Aq.$$

From this it will be seen that the organic compounds are not the only ones possessing complicated molecules.

Resistant Filter-Paper. — A French chemist finds that filter-paper, if dipped for a moment in nitric acid of the density 1.42, and immediately washed in plenty of water, becomes much stronger than before, and may be used for filtering under pressure without the use of a protecting cone for the tip.

The Uses of Soda-Paper. — The *Moniteur de la Photographie* of Paris calls attention to soda-paper, which is now put to many useful purposes in chemistry and photography. It is frequently used to protect silver and silver salts and preparations from the effects of sulphur. It acts as a chemical filter, eliminating sulphuretted hydrogen and sulphurous acid gases from the air. In this manner objects of silver, and metals in general, such as the beams of a balance and surgical instruments, are kept bright and clean. In order to preserve sensitive paper, the sheets of it are placed alternately between sheets of soda-paper, or a roll of the sensitive paper is enveloped in the latter. Soda-paper is produced in large sheets, by steeping for some time in a ten or fifteen per cent solution of carbonate of soda, and then drying so that the paper does not curl.

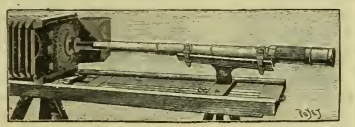
The Separation of Slimy Precipitates. — Zulkowsky recommends the use of ether as a means of rapidly separating slimy precipitates In many cases, he says, such separation may be quickly accomplished by shaking the containing liquid with one-third of its volume of ether. The ether is said to surround the precipitate, and carry it to the surface, so that it can be easily poured off from the clear underlying liquid. The ether then rapidly evaporates from the precipitate. The author says he has found the plan useful in the separation of organic compounds as well as organic precipitates.

New Dynamo-Machine. — A new self-exciting dynamo-electric machine, the invention of MM. Dandeu and Cherteмps, is described in *L'Electricité* as giving remarkable effects. A wooden board is pierced with holes, in which are solidly fixed six coils, and is fixed on a support. Through a hole in its centre passes a movable axis. In a plane perpendicular to the board are two groups of three horseshoe magnets, with coils similar to those in the board, and making twelve hundred revolutions per minute. It is on the fixed board that the currents are collected, by an arrangement which allows of grouping them in as many currents as there are cylinders, less one; the electricity of this latter cylinder not being used for exterior work, but serving to excite the moving electro-magnets It appears that the machine consumes a motor force of only four-horse power while supplying ten Jablochkoff candles in a normal way. The special merit of the machine is said to consist in the suppression of the induction currents which are produced in the heart of the iron pieces facing each other in other generators.

Practical Chemistry and the Arts.

PHOTOGRAPHY AT LONG DISTANCES.

In the last number (p. 171) we made brief mention of a "telescopic camera," by which photographs of objects at a distance could be taken of much larger size than with the ordinary instrument. The accompanying cuts, taken from *La Nature*, show the arrangement

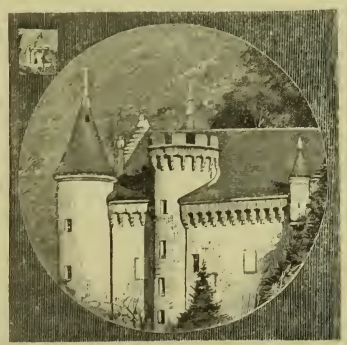


of the telescope and camera, and also the results obtained.

A common spy-glass will answer very well, although, of course, the better the quality of the lenses, the clearer will be the views obtained. It is adjusted to the proper focus, and attached to the objective of the camera either by a brass screw-joint or by strips of cloth or paper. The farther the camera is drawn out, the larger will be the photograph; but increased size will be obtained at the expense of clearness and sharpness of definition. The lenses of the camera can even be dispensed with, and the view focussed upon the plate by the telescope alone; but, except with a very superior instrument, the results are unsatisfactory.

The illustration given is copied from a photograph, obtained by a French amateur, of the turrets of an old castle in Savoy, at a distance of three-quarters of a mile, with ninety seconds exposure. In the upper corner at A is shown the same object taken in the ordinary way, with an exposure of five seconds. The difference is very striking.

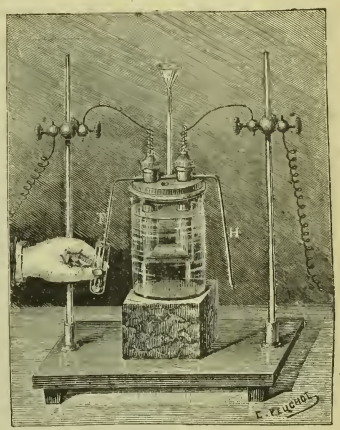
The practical applications of this method



of photography are very numerous. The details of mountain-peaks and other inaccessible places can be brought near to us, as it were, and preserved upon the photographic plate; aeronauts can obtain pictures of the earth's surface from the car of their balloon much more satisfactory than those hitherto taken; in military or naval operations the movements of the enemy can be photographed by sconts, and transmitted to the commanding officers; in some cases it might lead to the detection of criminals; and, in fact, there are many ways in which telescopic photography may prove of practical value, besides providing a new means of amusement to the rapidly increasing class of amateur photographers.

THE ISOLATION OF FLUORINE.

We have previously mentioned in the *News* (p. 145, October, 1886) the decomposition of hydrofluoric acid into hydrogen and fluorine by the French chemist Moissan, and we reprodnce from *La Nature* an illustration of the apparatus employed. The intense chemical activity of fluorine, which attacks almost every known substance, has hitherto rendered it impossible to separate the element from its compounds; but, by an ingenious apparatus of



platinum and fluor-spar, it has at last been accomplished.

The first step in the process is to obtain a perfectly anhydrous hydrofluoric acid, which is made by heating a carefully dried acid fluoride of potassium (K Fl, H Fl) in a small platinum still, and condensing the acid in a platinum tube surrounded by a mixture of ice and salt. A sufficient quantity of the acid having been condensed, it is transferred from the condenser to the platinum U-tube through one of the small side-tubes *F*, *H*. These are afterwards placed in test-tubes containing caustic potash, to prevent the entrance of aqueous vapor from the air. In fact, the greatest care is necessary, in all steps of the process, to avoid the presence of even a trace of moisture, which would prevent the success of the experiment by causing the formation of ozone.

The two larger openings in the U-tube are closed by ingenious stoppers of platinum, which screw into them tightly. The central part of the stopper is formed of a piece of fluor-spar, pierced with a small hole to allow the passage of the platinum wire conducting the electric current. It is then covered with a coating of shellac, which renders it perfectly air-tight. The whole apparatus is placed in

a vessel filled with liquid chloride of methyl, which produces by its evaporation a temperature of — 8° F.

When a current produced by twenty Bunsen cells is passed through the hydrofluoric acid (H Fl), it is decomposed; hydrogen (H) being formed at the negative electrode, and fluorine (Fl) at the positive, which collect in the upper part of the arms of the U-tube, and can be drawn off through the lateral branches. It is to be noted, that the pure anhydrous acid almost completely stops the electric current; and it was found necessary to add a little of the acid potassic fluoride mentioned above to give it the necessary conductivity. If the decomposition was continued till the level of the acid sank so that the two arms of the tube connected with each other, the hydrogen and fluorine recombined with a violent explosion, notwithstanding the low temperature. Certain experiments undertaken by M. Moissan show that the gas evolved at the positive pole contains no hydrogen, and is undoubtedly fluorine.

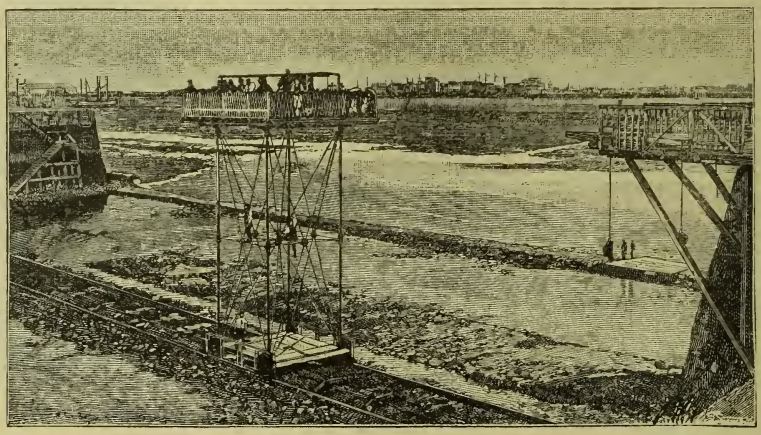
The properties of the element are about what would have been expected. Silica takes fire, and burns brilliantly in the gas, being transformed into fluoride of silicon; adamantine boron burns equally well. Sulphur, iodine, arsenic, and antimony all combine with it, with flame or incandescence. It decomposes water, forming hydrofluoric acid and ozonized oxygen. Nearly all metals are attacked by it, but less violently, owing probably to the formation of a protecting crust of metallic fluoride. It acts with great energy upon organic bodies, carbonizing them, and at once inflaming liquids like alcohol, ether, turpentine, petroleum, etc.

No one but a chemist can have any idea of the difficulties attending an experiment like this, which is so easily and quickly described. The substances used were of the most dangerous nature, and a single inhalation of the fluorine would probably have caused instant death. The apparatus employed was of a novel pattern, and required great mechanical skill for its manufacture. The necessary precaution of removing all traces of moisture from materials and apparatus, was a task of no small difficulty; and, in fact, nearly all the minor details of the process required a large amount of scientific knowledge and manipulative skill to successfully carry out. In thus isolating the last and most refractory of the known elements, M. Moissan has performed a brilliant feat, and is fully entitled to all the credit belonging thereto.

A TRAVELLING BRIDGE.

The peculiar combination of bridge, cable-car, and ferry-boat represented in the engraving, is used to convey passengers and vehicles across the harbor of St. Malo, in France, to the town of Saint-Servan, and has been in successful operation for fifteen years. The illustration is copied from a photograph taken at low water, so as to show the construction of the lower part. At high tide the water reaches nearly to the top, and the "bridge" presents a very strange appearance as it travels across the water like some gigantic insect.

The structure is about thirty-three feet high, and moves upon rails laid on the bottom of the harbor. It is built as lightly as is consistent with safety, so as to avoid friction in passing through the water. The motive-power is applied by wire cables connected with a stationary engine. The distance traversed is about two hundred and seventy-five feet, and



the trip is made in a minute and a half. No accident has ever occurred, and communication has never been interrupted by wind or weather.

This system of transportation is especially adapted to small harbors or streams where an ordinary bridge is impracticable, either on account of the expense, or interference with navigation; and there are doubtless many localities in this country where a similar institution would be a great public convenience as well as a paying investment.

INDUSTRIAL MEMORANDA.

To soften wrought-iron, heat the iron to a low red heat, and cool it in soft soap, then re-heat to a low red, and let it cool in lime. This makes wrought-iron very soft.

There is no absolute need of painting zinc-work, for exposing it to the atmosphere has the effect of coating it with a thin film of oxide, which protects it from the future action of the air as effectually as paint.

Oak may be darkened by exposure to the fumes of ammonia in a close box; but if the work is first oiled with linseed oil, and wiped dry with a cotton or linen cloth, and then a solution of bichromate of potash (say half-ounce of potash to one pint of of water) be applied, it will darken it, and not raise the grain, either of oak, mahogany, or cherry. Care, however, must be taken that the work is not made too dark by too many applications of the solution.

Plumbers should be careful not to use lead in contact with oak, unless the latter is perfectly dry and free from sap; otherwise, the gallic or acetic acid in the wood will turn the lead into acetate of lead, or ceruse.

The amount of force exerted by heat and cold in expansion and contraction of metal, is equal to that which would be required to stretch or compress it to the same extent by mechanical means.

Pulverized Steatite for Walls, etc. — As a finish or covering for walls and ceilings, pulverized steatite is coming into use quite satisfactorily. It is simply soapstone. It takes a high polish, is pearl-gray in tint, is said to present the best possible surface for painting, either in oil or water-color, and, what is very desirable, will neither crack nor chip. It is claimed for it that it is a non-conductor and non-absorbent; that it can be washed without injury; nails can be driven into it without damage; when subject to heat, moisture, and chemical fumes, it gives no smell; and it does not turn yellow with age. It is thought to be specially adapted for hospitals, factories, cellars, markets, etc.

To Treat Wooden Tools. — The wooden parts of tools, such as the stocks of planes and handles of chisels, are often made to have a nice appearance by French polishing; but this adds nothing to their durability. A much better plan is, to let them soak in linseed-oil for a week, and rub with a new cloth for a few minutes every day for a week or two. This produces a beautiful surface, and at the same time exerts a solidifying and preservative action on the wood.

The Maxim Gun. — This new and wonderful weapon is a gun weighing only sixty-five pounds, mounted upon a light tripod, which can be lowered, raised, moved literally with one hand as easily as a garden hose, and which pours out automatically six hundred shots a minute. There is no crank to turn; there is no labor of feeding. One man simply sets the bullets going, and then directs it at will; raking a whole regiment front if he likes, or keeping the fire within a range of five feet or five inches. The basis of it all is the utilization of the recoil force to fire the next shot.

Iron Now and Then. — It is often observed that iron of recent make rusts and wears away much more rapidly than samples made forty or fifty years ago. The more rapid deterioration of much of the iron of a late make arises from the fact that it contains more impurities than formerly. The common iron of to-day is filled with slag, and looks coarse and fibrous when rusted or worn. Fifty years ago the iron made in the United States was largely charcoal iron, and was much purer and better than the same grades made at the present day.

Home, Farm, and Garden.

THE HOUSEKEEPER AS A CHEMIST.

A professor of chemistry was wont to remark to his class, that every chemist ought to be a good cook. the operations in those two widely separated occupations being so similar. It is true that the processes of evaporation, distillation, desiccation, etc., have a strong resemblance to those carried on by the presiding genius of the kitchen ; and. conversely, the housekeeper, in her every-day work, avails herself unconsciously of many important scientific principles.

The substances used as food belong mainly to the class of organic bodies. They are composed principally of carbon, hydrogen, oxygen. and nitrogen, and are of a very complex constitution. The action of heat upon them is often to change their character very decidedly, and yet in many cases the chemist cannot perceive any difference in their composition. Take the case of albumen. for instance, which forms the white of an egg, and is also present in meats of all kinds. Its chemical formula is approximately $C_{72}H_{112}N_{18}O_{22}S$. Upon heating to 163°, the watery liquid becomes changed into a tough, white solid, more or less difficult of digestion ; but the change appears to be only a physical one. and the chemical composition remains the same. This property of coagulation is made use of in clearing coffee from its sediment. When the liquid white of egg is stirred into the boiling coffee, it solidifies at once, enclosing in the mass all the particles held in suspension, and leaving the liquid beautifully clear. The action of fish-skin is similar, only in this case the gelatine of the skin unites with the tannin of the coffee to form a leathery substance, which acts like the coagulated albumen.

Gelatine is made from the bones and tissues of animals, and is of considerable importance in the domestic economy. In its coarser forms it is known as glue, but when properly refined forms the bright, clear, cooking gelatine. Its most characteristic property is that of gelatinization. It is insoluble in cold water, but absorbs it, swelling up, and becoming soft. Upon heating the water, it rapidly dissolves ; and upon cooling again, after a while sets into a more or less firm mass, known as jelly. Prolonged boiling of the solution causes it to lose this property, as housewives frequently discover to their sorrow when the jelly absolutely refuses to "jell." The addition of a small quantity of strong acid, like nitric, also destroys this property, without injuring its adhesive qualities ; and the familiar "prepared liquid glue" is made in this way. Fruits contain a body known as *pectine*, which also possesses the property of gelatinizing, although its composition is very different from true gelatine, which is found only in animal organisms.

The stimulating effects of coffee and tea are due to an alkaloid known as caffeine or theine, according to the source from which it is obtained. Its composition is the same in both cases ($C_8H_{10}N_4O_2$), and the pure alkaloid is frequently used in medicine. The agreeable flavor of these beverages is due to various aromatic substances which are extracted by the boiling water from the leaf or berry ; but the restorative and exhilarating effects must be credited to the alkaloid, which seems to bear some resemblance to the well-known cocaine.

Flour is one of the most indispensable articles used in the family. It consists principally of starch, with more or less gluten and inorganic or mineral constituents, according to its coarseness or fineness. Some of the finest bolted flours consist almost entirely of pure starch, and are inferior in nutritive value to the coarser varieties, although they make a whiter and more attractive loaf of bread. The "raising" of dough is a true process of fermentation, precisely similar to that of the brewer or whiskey-distiller. The yeast-plant, when mixed with the flour, acts in some mysterious way upon the starch, first transforming it into grape-sugar, and then breaking this up into alcohol and carbonic-acid gas. The alcohol is partially driven off by the heat of the oven, though in a freshly baked loaf its odor is quite evident ; and the carbonic-acid gas permeates the dough, its expansion causing it to puff up, or "rise," rendering it light and spongy.

Two molecules of starch ($C_6H_{10}O_5)_2$, with the addition of a molecule of water (H_2O), form a molecule of cane-sugar ($C_{12}H_{22}O_{11}$), another substance in universal use. Unfortunately it is only in the wonderful laboratory of the growing plant that this combination can be effected, or the price of sugar would be even less than at present. It readily crystallizes, forming either granulated sugar or rock-candy according to the size of the crystals. By heating, it melts, and upon boiling is changed into a pliant, uncrystallized mass, known as barley-sugar or sugar candy. At a somewhat higher temperature it becomes partially decomposed, and a dark-brown substance, known as caramel, is formed, which is sometimes used for giving a rich color to soups and gravies. Granulated sugar is seldom or never adulterated, the peculiar form of the crystals rendering any foreign admixture very easy of detection. In the cheaper forms of coffee-crushed and brown sugars much moisture, molasses, and glucose are frequently bought at a high price.

The term "salt" is a familiar one, and is applied not only to the condiment of the table, but to all combinations of an acid and base. Chemically speaking, tallow and the various greasy substances used in soap-making are true salts, consisting of palmitic, stearic, oleic, and other fatty acids, as they are called, united with glycerine as a base. Upon the addition of caustic soda or potash, the acids separate from the glycerine, setting it free, and unite with the alkali, forming soap. Hard soaps are made from soda, and soft soaps from potash. The cleansing action of soap is not well understood, but is doubtless due to the action of the alkali contained in it. Additions of soda-ash, borax, resin, etc., are often made to soap, but are of questionable advantage.

This list of the applications of science to domestic affairs might be extended indefinitely ; but enough has been said to show that the great principles of nature control the most common affairs, as well as the experiments of the chemist or physicist.

THE AGRICULTURAL POSITION OF ENGLAND.

It has always been taken for granted that the English people had increased to such an extent that their land was insufficient to support them, and that in case of war and a blockade of their ports a large proportion would starve. Sir J. B. Lawes, one of the best authorities in England on agriculture, has arrived at a different conclusion, and his observations in a recent number of the *Agricultural Gazette* are of interest.

Some time ago, without any view to publication, I sat down to consider what would be the result of the British Isles being in a state of blockade. Britannia having ceased to rule the waves, I tried to work out the problem whether she could be starved into submission, or — assuming that the whole energies of the nation were devoted to the production of food, and the country had resolved to resist up to the point of starvation — whether the resources of the soil, aided by the knowledge which we have acquired regarding the food of plants, would enable us to feed the vast population which depends so largely upon the products of foreign soils for its daily sustenance.

Assuming that the blockade was at all sudden, it is probable that the chief strain would be in the early period of the struggle, as we should not only have to provide food, but also have to reserve a much larger quantity of seed than usual to provide for the crops of the succeeding year. This important point being once settled, there would not appear to be any insuperable difficulty in providing food for our population, although the diet would not include many of those luxuries which at the present time are almost considered necessaries by a large bulk of our population.

Under these altered conditions the production of manure from various sources would find employment for great numbers of our people In the wars of the first Napoleon, when our fleets prevented his obtaining saltpetre from India for the purpose of making gunpowder, home-made manures furnished it in large quantities. In like manner, our supplies of guano and nitrate of soda being cut off, we should be compelled to find a substitute of home manufacture. Then would be the time when the sewage of London, evaporated to dryness or distilled, would give us some idea of the value of what the writer of a leading article in the *Agricultural Gazette* calls "the fertilizing power of four millions of the best-fed animals in the world."

The writer evidently deplores the loss of material of so much value, its practical application to our soils having been abandoned by all those competent to deal with it, except the enthusiast. If professional men have given up the attempt to utilize it in despair, the enthusiast is still seeking for a solution of the problem, and only a few days ago the *Pall Mall Gazette* contained a drawing of some machine resembling a Jacob's ladder, by which the sewage or sludge was to be elevated and cremated. The writer in the *Agricultural Gazette*, at

the conclusion of his article, seeks to find some connection between the increasing difficulty experienced in some districts of growing turnips, and the invention of the water-closet. Accepting the writer's view that the soil of the country as a whole is poorer to-day "than when we were boys," I should hardly feel disposed to seek for the reason in any change in the sanitary arrangements of our towns.

It appears to me that more sentiment has found utterance in regard to the London sewage than it deserves. Take the peat-bogs in Ireland, for instance. Peat, when dried, is an excellent fuel; but the cost of drying and transport prevents it from entering into competition with coal. If it were not for the coal in Great Britain, Ireland would be the more wealthy country of the two. But no one dwells upon the great value of the Irish bogs, though we are continually being told of the immense value of the London sewage. In both cases it is the cost of labor and transit that prevents these substances from entering into competition with other substances of the same character which are more cheaply brought upon our farms.

CLEARING WASTE-PIPES.

THE annoyance arising from the stoppage of waste-pipes in country houses, although very great, is but a small matter compared with the dangers which may follow obstructed pipes. The "sewer-gas," about which so much has been written, and which is so justly dreaded, is not, as many suppose, the exclusive product of the sewer. Indeed, the foul and dangerous gases are not only found in the sewers themselves, but in the unventilated waste-pipes, and those which are in process of being clogged by the foul matter passing through them. Any obstruction in the soil or waste-pipes is therefore doubly dangerous, because it may produce an inflow of foul gas into the pipe, even though the entrance to the sewer itself has been entirely cut off.

The question is, how to get rid of the accumulations in pipes partly stopped or already closed. Digging up and cleaning out is a costly remedy, often ineffectual by reason of careless workmen. The second is the plumber's force-pump, which is usually only a temporary relief.

In pipes leading from the house to the cesspool, there is a constant accumulation of grease. This enters as a liquid, and hardens as the water cools, and is deposited on the bottom and sides of the pipes. As these accumulations increase, the waterway is gradually contracted, till the pipe is closed.

When the pipe is entirely stopped, or allows the water to fall away by drops only, proceed thus: Empty the pipe down to the trap, as far as practicable, by "mopping up" with a cloth. If the water flows very slowly, begin when the pipe at last emptied itself. Fill the pipe up with potash, crowding it with a stick. Then pour hot water upon it in a small stream, stopping as soon as the pipe appears to be filled As the potash dissolves and disappears, add more water. At night a little heap of potash may be placed over the hole, and water enough poured on so that a supply of strong lye will flow into the pipe during the night.

Pipes that have been stopped for months may be cleaned out by this method, though it may call for three or four pounds of potash. The crudest kind, however, appears to act as well as the best. If the pipe is partially obstructed, a lump of crude potash should be placed where water will drip slowly upon it, and so reach the pipe.

It is also well to fill the upper part of the pipe with the potash, as before, and allow hot water to trickle upon it Soda and potash are both used for the purpose of removing greasy obstructions, and the usual method of application is to form a strong lye, and pour it into the pipe.

It is better to put the potash into the pipe, because the water which it contains, instead of diluting, helps to form the lye. As water comes in contact with the potash, it becomes hot, thus aiding in dissolving the grease. Potash, in combination with grease, forms a "soft" or liquid soap, which easily flows away; while the soda makes a hard soap, which, if not dissolved in water, would in itself obstruct the pipe.

When a pipe is once fairly cleaned out, the potash should be used from time to time, in order to dissolve the greasy deposits as they form, and carry them forward to the cesspool or sewer. The potash is very valuable for this purpose, because, in addition to its grease-solving powers, it is exceedingly destructive to all animal and most vegetable matters.

The most dangerous gases appear to come from urinals and wash-basin pipes, these in many cases seeming to be more foul than those from water-closets. The decay of the soap and animal matter washed from the skin appears to be the source of the gases. The potash will be effective in keeping these pipes clear, and in this way may lessen the dangers. — *Artisan.*

CROQUET.

EDITORS SCIENCE NEWS:

A SUBSCRIBER, after reading the interesting article, in the November number of the *Popular Science News*, upon "Physical Exercise," would like very much to have added to the list, as one of the truly recreative outdoor sports, albeit not requiring any thing but moderate exercise, the modern game of croquet Those to whom, especially in warm weather, the game of tennis would be altogether too violent, and that of base-ball too fatiguing, if not actually impossible, will find in croquet a most excellent substitute. The November number of *Outing* says: "The game, which is thought by very many persons to be incapable of any special points of excellence, devoid of any science, and a sort of wishy-washy method of passing away the time, suited to children and weaklings generally, has, by the efforts of the various members of the National Association, had a really scientific character stamped upon its method of play, that has brought it to the front of those games which require great skill and nerve, and call for the exercise of the soundest judgment." Upon the perfectly level sanded grounds, as now constructed, the player may have much enjoyment; and the open-air exercise adds to the benefit received.

C. J.

HOUSEHOLD HINTS.

THE color of old oak is pleasant for bed-chamber woodwork; in north rooms terra-cotta paper of an old pink shade is pleasing, and in south rooms olive-green of a middling dark and golden shade. Tint ceiling pale, soft, olive-green.

BITING OFF THREADS — Many ladies use their artificial teeth as substitutes for scissors, and such use of them soon renders repair necessary. When told that they should not bite threads with them, they are surprised. But they should be taught not to use even their natural teeth for such purposes. But few think that in biting off a thread the entire muscular force of the jaws in use is concentrated into the small space measured by the diameter of a thread. Besides, thread after thread is applied to the same place on the teeth, and thus the enamel is soon broken there.

FOOD AND CONSCIENCE. — Edward Everett Hale says: Never go to bed in any danger of being hungry. People are kept awake by hunger quite as much as by a bad conscience. Remembering that sleep is the essential force which starts the whole system, decline tea or coffee within the last six hours before going to bed. If the womenkind insist, you may have your milk and water at the tea-table colored with tea; but the less the better. Avoid all mathematics or intricate study of any sort in the last six hours. This is the stuff dreams are made of, and hot heads, and the nuisances of waking hours. Keep your conscience clear. Remember that because the work of life is infinite, you cannot do the whole of it in any limited period of time, and that therefore you may just as well leave off in one place as another.

THE ART OF RISING EARLY. — The proper time to rise is when sleep ends. Dozing should not be allowed. True sleep is the aggregate of sleeps, or is a state consisting in the sleeping or rest of all the several parts of the organism. Sometimes one and at other times another part of the body, as a whole, may be the least fatigued, and so the first to awake; or the most exhausted, and therefore the most difficult to arouse. The secret of good sleep is, the physiological conditions of rest being established, so to work and weary the several parts of the organism as to give them a proportionately equal need of rest at the same moment. And to wake early, and feel ready to rise, a fair and equal start of the sleepers should be secured; and the wise self-manager should not allow a drowsy feeling of unconsciousness, or weary senses, or an exhausted muscular system, to beguile him into the folly of going to sleep again when once he has been aroused. After a few days of self-discipline, the man who resolves not to doze, that is, not to allow some sleepy part of his body to keep him in bed after his brain has once awakened, will find himself, without knowing why, an early riser.

GLEANINGS.

SPIDERS AND FORESTS. — Dr. C. Keller of Zurich claims that spiders perform an important part in the preservation of forests by defending the trees against the depredation of aphides and insects. He has examined a great many spiders, both in their viscera and by feeding them in captivity, and has found them to be voracious destroyers of these pests; and he believes that the spiders in a particular forest do more effective work of this kind than all the insect-eating birds that inhabit it. He has verified his views by observations on coniferous trees, a few broad-leaved trees, and apple-trees.

IT is now recommended to boil shingles intended for a roof in a solution of lime and salt. It is claimed that it adds a good many years to the usefulness of the shingles, by preventing them from decaying.

EXAMINATION OF EDIBLE BIRDS'-NESTS. — According to the *Pharmaceutical Journal* the substance of which edible birds'-nests are composed has been examined by Mr. J. R. Green. He finds that neossin, the name given to this substance by Krukenberg, resembles mucine, but differs from it chiefly in being insoluble in five-per-cent hydrochloric acid and in dilute alkalies, while mucine is soluble in both. Acetic acid only renders a solution of neossin opalescent, but precipitates mucine. Neossin is digested by pepsin, but mucine is not. Mucine, when dissolved in soda, yields to ether a substance which is colored green by ferrous chloride; but the nest substance does not. The author believes that the nest material is an animal product formed by the glands described by Bernstein, which he states are remarkably developed in the nest-building season, but become atrophied afterwards.

The Popular Science News.

BOSTON, JAN. 1, 1887.

JAMES R. NICHOLS, M.D.
WILLIAM J. ROLFE, A.M.
AUSTIN P. NICHOLS, S.B. } . . . . . *Editors.*

The tenth edition of Dr. Nichols's book, "Whence, What, Where?" has just been published in an improved form, and the price advanced to $1.25. *New subscribers remitting* $1.50 *will receive both the book and the* SCIENCE NEWS *for one year, as heretofore. The paper edition (price 50 cents) will be given* FREE *as a premium to every new subscriber.*

To avoid misunderstanding, subscribers entitled to the premium copy will please state in their letter that they desire it; otherwise, there may be delay in sending it.

Our readers will notice, that, in the present number, the "Agricultural" department is changed to one of "Home, Farm, and Garden." While we do not intend to neglect in any way the science of agriculture, it has been thought best to extend the scope of this department, giving some attention to the science of the household, as well as to that of out-door operations. We trust the change will be acceptable to our subscribers, and increase the usefulness of the *News*, as well as the favor with which it has hitherto been received.

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While our subscribers frequently favor us with words of commendation, our contemporaries in the journalistic field are not altogether forgetful of our existence. A recent issue of the *Scientific American Supplement*, in copying the article, in the October number, "A Look through the Great Object-Glass," says: "We take pleasure in stating that we are indebted to the *Popular Science News* for the article. Professor Young has long been a contributor to the pages of our enterprising contemporary." Such words are always fully appreciated by the editors of the *News*, and in this case we can most heartily reciprocate the good opinion which the *Supplement* expresses.

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We publish in this number a "Summary of Medical Progress," prepared by Dr. W. S. Wells of New York, expressly for the *Science News*. Dr. Wells has unusual facilities for obtaining the latest news from European sources, and his "Summary," which will appear every month, will doubtless be of great interest.

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Much interest has been excited in Boston by a Mr. Bishop, a so-called "mind-reader." With the assistance of several well-known citizens of Boston, he performed some very remarkable feats, such as indicating on a blackboard the number of a bank-note known only to the person whose hand he was holding, and discovering by the same means, while blindfolded, a small object previously concealed in a building at a distance from the one where the experiments took place. Bishop claims that there is actual "thought-transferrence" to his mind from that of the "subject;" but we fail to see any satisfactory basis for the fashionable theories of "thought-transferrence," or "mind-telepathy," to rest upon. The proceedings of Bishop, so far as regards the use of connecting wires between himself and others, and the holding of his head between the hands of his assistants, must be regarded as mere "clap-trap," as in hundreds of instances the same experiments have been performed with even better success by others entirely free from such connections. By the use of unnecessary trumpery, and by giving to the psychical phenomena a name tolerated among the educated classes, he secured an audience composed of distinguished men, who under other circumstances would not have been present.

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The address of Professor William Crookes before the British Association, upon the "Genesis of the Elements," is one of the most important contributions to chemical philosophy that has been published for a long time. Reasoning from the recently discovered law of periodicity among the elements, he discusses the possibility of their being formed from the cooling of one primitive form of matter, which he calls *protyle*. While he admits that we have no direct evidence that the elements are different manifestations of the same form of matter, yet he thinks that the observed phenomena of chemistry and physics point very strongly to such a conclusion, and agrees with Faraday, that, "to decompose the metals, then to reform them, to change them from one to another, and to realize the once absurd notion of transmutation, are the problems now given to the chemist for solution." We consider Professor Crookes to be one of the most eminent scientists now living, and any views he may advance are entitled to serious consideration. We hope at some future time to refer to his address more at length, giving it the attention it deserves.

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The largest dry-plate negative ever made was produced in this city last summer by Mr. T. R. Barnham. It measures three by five feet, and weighs over eighty pounds. Over three pailfuls of developing solution were used, and the successful manipulation of this enormous plate required unusual skill. All the operations were successfully conducted, and the result was a very perfect life-size portrait of a lady. It is not probable that pictures of this size will ever become very common, owing to the difficulty of handling the plates, and the cost of the necessary apparatus.

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Steps have finally been taken in New York and Brooklyn to abate the telegraph-wire nuisance, and subways are now being constructed in which the wires will run underground through the principal streets. The "electrical conduit is formed from rectangular blocks composed of a mixture of sand and coal-tar pitch, pierced with twelve holes, each of which will accommodate one hundred wires. At every cross street there will be man-holes, by which access to the subway is attained, and for which the wires for local service will branch off. The difficulties in the way of carrying wires underground are much greater than the general public suppose; and, if the present scheme proves successful, it will not only add greatly to the beauty and safety of the city streets, but will be a welcome solution of a vexatious scientific problem.

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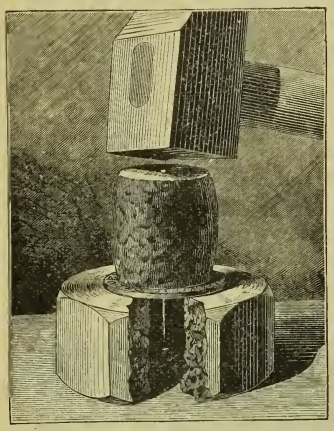
SCIENTIFIC RECREATIONS.

An entertaining experiment, by which wine is apparently changed into milk, can be performed by adding to tincture of iodine some glacial acetic acid. A red liquid resembling wine will result; if a solution of hyposulphite of soda is now added, the red color will disappear, and a milky-white fluid will be obtained. Another striking change of color can be produced by turning a solution of iodide of potassium into a dilute one of mercuric chloride

(corrosive sublimate). A brilliant red precipitate of mercuric iodide is at first produced, which, upon the continued addition of the iodide of potassium, redissolves, leaving the liquid clear again. As the above experiments require the use of corrosive and poisonous substances, we would not recommend their being attempted by persons not accustomed to the handling of chemicals.

Take a piece of wood an inch or so in thickness, and cut a hole through it of the shape shown in the illustration. By blowing through the larger end at a candle, it is at once extinguished in the usual manner; but by blowing in the opposite direction, through the smaller opening, the current of air, upon emerging, is so spread out that a partial vacuum is formed, and, instead of the candle being extinguished, the flame is actually drawn towards the opening. A piece of cardboard rolled up into the proper form will answer equally well for the experiment. The same principle may also be shown in several other ways, as by bending down the ends of a visiting-card so that it will stand like a stool about three-eighths of an inch high. Place it on a table, and it will be found almost impossible to blow it over, as the air, rushing underneath it, causes a sufficient vacuum and downward pressure to keep it in place. It can, however, be accomplished by blowing upon the *table* two or three inches in front of the card, when the blast will be reflected at such an angle as to overturn it at once. Or, take a short piece of glass tubing or quill, and

attach a disk of cardboad to one end of it, even with the opening. Place a similar disk of cardboard upon the first; and, on blowing through the tube, it will be found impossible to blow it off. The second disk should have a pin thrust through it, extending down into the tube, to prevent its sliding off. The principle is the same as in the other cases, a vacuum



being formed between the two disks by the current of air rushing between them.

Although steel is harder than copper or silver, it would be a difficult feat to penetrate a coin with a needle in the ordinary way; but if it is thrust into a cork of just the same length as the needle, and then placed upon the coin, and given a quick, heavy blow with a hammer, the needle will be driven completely through it. To insure the success of the experiment, the needle should be exactly covered by the cork, and must be placed so that it stands directly vertical to the face of the coin; but several trials may be necessary before it is accomplished. The coin may rest upon a piece of

soft wood if the nut represented in the engraving cannot be obtained. It is due to the principle of inertia; the quick blow driving the steel needle, supported by the cork, through the softer metal before it has time to bend or break.

The other illustration shows a "magic flower," which some of our ingenious young readers may like to construct. The flower is composed of four green leaves, the upper ones on each side being weighted with a bit of sheet-lead, concealed between the two pieces of paper of which they are composed, as shown in the right-hand figure. Between the four leaves are placed three pieces of colored paper, folded so as to open or shut like a fan. Each of the three is of a different color, and, when the weighted leaf is thrown over it, is entirely concealed. Thus, a simple twist of the hand will enable one to show the flower of different colors according to the position of the weighted leaves; the different pieces of colored paper closing or unfolding as the position of the leaves changes. A flower much larger than the one represented will be easier to construct, and quite as effective.

THE BLUE-HILL METEOROLOGICAL OBSERVATORY.

BLUE HILL is an eminence situated about ten miles south of Boston, and rising to a height of some six hundred feet above the sea. At the summit of this hill there has been erected one of the most completely equipped meteorological observatories in the country. It is the private property of a Boston gentleman, Mr. A. L. Rotch, and is carried on independently of the government or other signal-stations.

The observatory proper consists of a round stone tower, connected with a small dwelling-house for the use of the observer and his assistant. The lower story of the tower is used as an office and room for the observer, and contains standard barometers, and a beautiful self-registering barograph, which automatically records on paper, variations of a hundredth of an inch, and will indicate with fair accuracy to the thousandth of an inch. The barograph consists of two reservoirs of mercury, an upper and lower one, connected by the barometric tube. The lower reservoir is suspended by steel springs of great delicacy, and carries a pen which touches a sheet of paper marked off into hours and minutes, and moved along by clockwork. If the barometric pressure rises, a certain amount of mercury is forced into the upper reservoir from the lower one, which thereby becomes lighter, and is raised by the springs, causing the pen to mark the change on the paper. At the end of twenty four hours the paper is removed, and the record thus obtained filed away for future reference.

It was with this instrument that the observer Mr. H. H. Clayton first observed the peculiar variation of barometric pressure caused by high winds sweeping past the openings communicating with the outer air, and creating a partial vacuum in the room where it was placed, as described in the *Science News* for September, 1886, p. 129.

Naturally most of the instruments are placed in the outer air upon the roof of the tower. Here we find anemometers, which consist of four hemispherical cups, placed horizontally upon cross-arms, and which revolve at a rate proportional to the velocity of the wind. The self-registering anemometer is connected with a shaft reaching to the office below, and the moment when a certain number of revolutions are completed is recorded upon a revolving cylinder of paper marked with the hours and minutes. The greater the velocity of the wind, the more numerous will be the units of revolution recorded in any given time; and from this record on the paper the velocity of the wind at any moment can be easily determined.

A similar self-recording apparatus is connected with a weather-vane, which shows the direction of the wind at all times.

Another device for determining the velocity of the wind depends upon its pressure to the square inch, and consists of a weather-vane provided at the end facing the wind with a sheet of metal exactly one square foot in area, attached to a simple spring-balance. The amount of force exerted by the wind is thus directly indicated on the balance, and from this its velocity can be easily calculated.

A polished metal plate marked with the points of the compass faces the zenith, and is used to observe the movement of the clouds reflected in it, thus showing the direction of the higher currents of air as compared with the winds at the level of the observatory. The great extent of country visible from the observatory also gives unusual facilities for determining the velocity of the clouds, by measuring the time in which their shadows pass over a tract of country of known extent.

Two "sunlight recorders" are in use which indicate the hours of sunshine during the day; one — described in the *News* last June — depending upon the charring of a strip of paper by the sun's rays, focussed upon it by a lens, and the other by means of the photographic action of the light upon a strip of sensitive paper.

Several rain-gauges of different patterns are in use; but the general principle of all is very simple, and consists in measuring the amount of water falling into an open vessel of known area. The summit of Blue Hill is an old rocky, treeless pasture, and is so completely open to the sky that it affords a good opportunity for observing the amount of rainfall, unaffected by the numerous errors which are likely to occur in rain-gauges exposed in cities, in the neighborhood of buildings, or among trees.

Earthquake shocks are not infrequently noted, but they are of extremely slight intensity, and belong rather to the class of "earth tremors." Probable changes in the weather are indicated from the observatory for the benefit of the surrounding country by means of signal-flags upon the tower. The proximity of Blue Hill to Boston and other large cities, and the extensive and beautiful view obtained from its summit, render it a place of frequent resort among pedestrians and excursionists, although the work of the observatory renders it necessary to close it to the general public. The establishment of such an observatory is of great importance from a scientific point of view; and valuable contributions to the science of meteorology may be expected from it, especially as, being under private control, it is free from the restrictions and formalities pertaining to the government signal-stations.

ASTRONOMICAL PHENOMENA FOR JANUARY, 1887.

The earth passes perihelion on Jan. 2. Mercury is a morning star, but is too near the sun to be seen, except, possibly, during the first two or three days of the month, when it rises more than an hour before the sun, and may perhaps be visible low down on the south-eastern horizon just before sunrise. Venus passed superior conjunction with the sun on Dec. 2, 1886, and became an evening star, but will not be far enough away from the sun to be easily seen until the latter part of January. Mars is still an evening star, but is too faint, and sets too soon after the sun, to be easily detected. It will not be a conspicuous object again until some months after its conjunction with the sun on April 24. Jupiter is a morning star, rising about 2 A.M. on Jan. 1, and at about midnight on Jan. 31. It is in quadrature with the sun on Jan. 24, and is moving slowly eastward in the constellation Virgo. Saturn is an evening star, rising at about sunset during the first of the month, and about two hours earlier by the end of the month. It is retrograding slowly, and is, on Jan. 8, in opposition; i.e., on the meridian at midnight. It is several degrees south and west of Castor and Pollux (*Alpha* and *Beta* Geminorum). Uranus is in quadrature with the sun on Jan. 2, rising soon after midnight, moves slowly eastward until Jan. 16, and then begins to retrograde (move westward). It is about 4° south-east of the third-magnitude star *Gamma* Virginis. Neptune is about 6° south of the Pleiades.

The first-magnitude star *Alpha* Tauri will be occulted by the moon on the evening of Jan. 6. At Washington immersion occurs at 5h. 26m., emersion at 6h. 18m., Eastern standard time. The time of the phenomenon for other parts of the country will be somewhat different.

The comet discovered by Barnard on Oct. 4 passes perihelion on Dec. 16, 1886. It became bright enough to be visible to the naked eye during November. At present (Dec. 3) it may be seen in the eastern sky in the early morning. The head is about as bright as a third-magnitude star, and there is a tail several degrees long. M.

Princeton, *Dec.* 3, 1886.

METEOROLOGY FOR NOVEMBER, 1886, WITH REVIEW OF THE PAST AUTUMN.

TEMPERATURE.

Average Thermometer.		Lowest.	Highest.	Range.
At 7 A.M.	35.50°	19°	54°	35°
At 2 P.M.	46.97°	35°	65°	30°
At 9 P.M.	37.90°	25°	57°	32°
Whole month	40.12°	19°	65°	46°
Second average	39.57°	19°	65°	46°
Last sixteen Novembers,	38.02°	31.12°, in 1873.	42.53°, in 1877.	11.41°
Second average	37.68°	30.62°	42.36°	11.74°
Autumn of 1886	50.28°	19°	82°	63°
Last sixteen autumns	50 27°	47.53°, in 1875.	53.57°, in 1881.	6.04°

The 27th was the coolest day of the month, with an average of 27⅔°; and the 3d was the warmest, at 56°, — a range of 28⅓°. The temperature of the entire month was 4 10° warmer than the average for the last sixteen Novembers, had less extremes, and was consequently more uniform than usual. The lowest point reached, 19°, at the hours of observation, was on the 28th, and the highest 65°, on the 18th. The lowest daily range was 5°, on the 19th. The most rapid rise was 26° in 7 hours, in the morning of the 5th, and the most rapid descent was 23° in 7 hours, in the afternoon of the 18th. The last autumn was nearly an exact average of the last sixteen, as seen by the table. The lowest point (19°) has not been so high, with two exceptions, in sixteen years, and its highest point (82°) has not been so low, with three exceptions, during the same time; leaving its range (63°) the very lowest, with a single exception, in sixteen autumns, illustrating the unusual uniform temperature.

PRESSURE.

The average barometer the past month was 29 911 inches, with extremes of 29.40, on the 13th, and 30.32, on the 16th, — a range of .92 inch. The average of the last thirteen Novembers has been 29.977, with extremes of 29 810, in 1878, and 30 193, in 1880, — a range of .353 inch. The sum of the daily variations has been 8.32 inches, giving an average daily movement of .277 inch. The average for the last thirteen Novembers has been .230, with extremes of .127, in 1882, and .293, in 1874. The largest daily movements were 73, on the 26th, and 71, on the 25th, in connection with rain and wind. The barometric changes were unusually large and frequent. The average barometer the last autumn has been 30 036 inches, while that of the last thirteen autumns has been just 30 inches, the highest barometric elevation of all the seasons in the year.

THE SKY.

The face of the sky in 90 observations gave 49 fair, 11 cloudy, 18 overcast, 11 rainy, and 1 snowy, — a percentage of 54 4 fair. The average for the last sixteen Novembers has been 54 6, with extremes of 40, in 1885, and 74 4, in 1874, — a range of 34 4. The month was a near average of fair weather. We had several fine days for November, and a few beautiful sunsets. Three mornings were foggy, — the 3d, 17th, and 30th, the last very dense. The percentage fair the past autumn was 55.6, while the average for the last sixteen has been 58, with extremes of 44, in 1882, and 69.2, in 1874.

PRECIPITATION.

The amount of rainfall the past month was 4 76 inches, well distributed. The average amount the last eighteen Novembers has been 4 01, with extremes of 1 10, in 1882, and 7 45, in 1877. Lightning with thunder occurred on the 6th, and again on the 18th, with a rainfall of over one inch on each occasion. The amount of precipitation since Jan. 1 has been 47.43 inches, while the average for this period in eighteen years has been only 41.89. The first snow-storm of the season occurred on the 13th, being only about one-fourth of an inch. The amount of precipitation the past autumn was 11 29 inches, being a trifle above the average (10 67) of the last eighteen autumns, with remarkable extremes of only 3 42 inches, in 1874, and of 20 08, in 1869.

WINDS.

The direction of the wind in 90 observations gave 8 N., 0 S., 1 E., 37 W., 6 N.E., 15 N.W., 5 S.E., and 18 S.W., — an excess of 6 northerly and 58 westerly over the southerly and easterly, and indicating the prevailing direction to have been approximately W. 5° 54′ N. The westerly winds have uniformly prevailed over the easterly in November for seventeen years by an average of 18 65 observations, and the northerly over the southerly, with four exceptions, by an average of 13 82; indicating the approximate general average direction for November to be W. 15° 52′ N. The longitudinal extremes have been 7 observations W., in 1877, and 73 W., in 1883, — a range of 66; and the latitudinal 44 N., in 1875, and 12 S., in 1879, — a range of 56. The relative progressive distance travelled by the winds the past month was 58 31 units, and during the past seventeen Novembers 859 8 such units, — an average of 50.56 The 7th was very windy all day; also the 18th, 19th, and 26th, characteristic of this usually most gloomy month. The average direction of the winds the past autumn has been W. 26° 16′ N., and that of the last seventeen autumns W. 9° 51′ N. The relative progressive distance travelled the past autumn was 113 8 units, and the last seventeen autumns 1,817 such units, — an average of 108.7.

In the October number the *heading* of the last line in the table should read "Last 16 summers," instead of "Second average." D. W.

Natick, *Dec.* 4, 1886.

HOW FAR CAN ONE SEE?

Editors Popular Science News:

In your issue of November it appears that certain mountains seen by Dr. J. N. Tilden from an elevation about eleven thousand feet above the level of the sea, in South-western Colorado, were recognized by his companion as the Wahsatch Mountains, three hundred and fifty miles away

On account of the curvature of the earth's surface, any point upon it must be below a line tangent to the surface at any other point This depression, or the height at which an observer must be to see an object at a given distance, may be easily calculated from a well-known formula which is sufficiently correct for moderate distances. It is $A = \frac{B^2}{D}$, where A equals the depression in feet, B the distance in miles, and D the diameter of the earth; or, in a convenient form for computation, $A = \frac{B^2 \times 5280}{7912} = \frac{2}{3}B^2$ miles, nearly.

From this it appears that the observer must stand 6,667 feet above the level of the sea to discern a vessel one hundred miles distant, and 26,666 feet when it is distant two hundred miles.

The horizon and any mountains upon it could not have been distant more than one hundred and twenty-eight miles from Dr. Tilden's station, under conditions theoretically most favorable. To have distinguished, "clear-cut against the distant sky, the characteristic outline of mountain-peaks" three hundred and fifty miles away from a point eleven thousand feet high, would require that the peaks stand upon a plane thirty-two thousand feet above the unbroken level of land between.

This and other considerations would prove that the mountains seen must have been much nearer than supposed. Henry Carmichael.

55 Kilby Street, Boston, *Oct* 26.

QUESTIONS AND ANSWERS.

Letters of inquiry should enclose a two-cent stamp, as well as the name and address of the writer, which will not be published.

Inquiries sometimes unavoidably remain unanswered till issue of the second number after they are received.

Questions regarding the treatment of diseases cannot be answered in this column.

P. B., *North Carolina.* — A good way to ventilate a room is to raise the window on the windward side a few inches, and close the opening at the bottom with a piece of board cut to fit it. A current of air will pass into the room in an upward direction through the opening between the upper and lower sashes, without creating any draft.

A SUBSCRIBER wishes to know what will remove the woody taste from a press made from fresh pine wood, and used for hot liquids.

G. W. E., *Denver.* — The "earth-shine" which we see on the unilluminated part of the new moon is a reflection of sunlight from the earth, which is then at the "full" as seen from the moon. The apparent diminution in size of the dimly illuminated part is due to an optical illusion known as irradiation. See "A Problem in Natural Philosophy" in the *News* for October, 1886. We do not see this appearance at the exact time of a new moon or during an eclipse, because it is masked by the more brilliant light of the sun. The strength of this light does not increase, but decreases, as the moon grows older.

H. B. M., *Boston.* — It is impossible to draw a line between the historic and prehistoric ages. The date would be different in every country. The actual date of the relics known as prehistoric is quite uncertain, though they certainly are of great antiquity.

J. M. A., *Texas.* — The acid sulphate of lime, which is a refuse product from the manufacture of soda-water, has no fertilizing properties whatever, and would probably destroy any crop to which it was applied.

G. W. W., *Ohio.* — The idea that a metal plate is used to replace portions of the skull removed on account of injury, bas no foundation in fact. There is no instance on record of such a proceeding.

INQUIRER. — We know of no remedy to prevent the poisonous action of bichromate of potassium upon the hands of those working in it. The best way is, to avoid bringing it in contact with the flesh as much as possible.

SUBSCRIBER. — It is better to connect lightning-rods directly to the iron mains; but, where this is not possible, a connection with the lead service-pipe will ve a good purpose. There is no danger in painting a rod, as the charge does not travel solely upon the surface.

R. W. D., *Massachusetts.* — A perfectly pure violet light can only be obtained from the solar spectrum, but that which passes through a piece of violet-colored glass or glass-paper will doubtless answer for your experiments.

H. R. F. — There is no reason why a fish kept in an unglazed earthenware jar should be in any better condition than one kept in a glass globe, except that the continual evaporation of water from the outside of the jar, as it oozes through, keeps the remaining water colder than would otherwise be the case.

LITERARY NOTES.

Lectures and Essays. By the late William Kingdon Clifford, F.R.S. Edited by Leslie Stephen and Frederick Pollock. Macmillan & Co., New York, publishers. Price $2.50.

The untimely death of Professor Clifford deprived the world of a philosopher and mathematician of the highest attainments, and who, as an expounder of the doctrine of evolution and the more radical systems of philosophy, is worthy to be classed with Herbert Spencer and other eminent scholars. The essays and lectures published in this work comprise such topics as "The Unseen Universe," "The First and Last Catastrophe," "The Scientific Basis of Morals," and others, which are worthy the earnest attention of every thinker. A portrait and biographical sketch of Professor Clifford are also given.

An Elementary Course in Practical Zoölogy. By Buel P. Colton. D. C. Heath & Co., Boston. Price 85 cents.

This work is designed to aid the student in obtaining a clear idea of the animal kingdom as a whole, by the study of a few typical animals. Nearly every young student is more or less interested in the animals which he daily meets with, and this little book not only gives very clear and interesting descriptions of their anatomical and structural features, but shows him how to dissect and observe them for himself. Special attention has been given to devising cheap appliances for collecting, preserving, and dissecting specimens, and the work deserves to be extensively used in schools and by amateur zoölogists.

The same firm publish in separate volumes, at 25 cents each, a series of *Monographs on Education*, by eminent specialists. The first three are now ready. *Modern Petrography*, *The Preparatory Study of Latin*, and *How to Teach Reading*, all worthy of the attention of teachers.

They will also publish, in April, a valuable book for teachers, entitled *Suggestive Lessons in Language and Reading*, by Anna B. Badlam, of the Rice Training School, Boston, Mass. These lessons are plain and practical, being a transcript of work that has been successfully done in the schoolroom.

Queer Questions and Ready Replies in Philology, Mythology, Science, Biography, Natural History, Geography, History, etc. By S Grant Oliphant. Boston: New England Publishing Company. Cloth. Price 75 cents.

This elegantly gotten-up little volume offers, in a convenient form, much quaint, curious, interesting, and instructive information. It will correct several popular fallacies, promote accurate scholarship, and explain many expressions used in every-day life. We give a few of its hundreds of questions that are answered: Who was the Shakespeare of India? Which is the only bird that can use both eyes at once in looking at an object? What bird has neither tail nor wings? Who was the "veiled prophet"? What is the "mother of cities"?

Select Poems of Robert Browning. Edited by W. J Rolfe, A.M., and Heloise E. Hersey. Published by the Harpers. Price 56 cents.

The recent popular interest in the works of Robert Browning has made a volume of selections from his poems seem a timely addition to Rolfe's English Classics. The book contains nineteen of the minor poems, and the drama of *Pippa Passes*. The Introduction includes a brief sketch of the life of Browning, a chronological table of his works, a list of the books most useful in the study of Browning, and carefully selected criticisms by Swinburne, Dowden, Lowell, Morley, Ruskin, Furnivall, and others. The Notes aim to explain the difficult allusions in which the poems abound, and to make clear such constructions as will not be easily understood except by the old student of Browning. The book is especially adapted for use in Browning clubs, as well as in all classes which have used previous volumes of the English Classics.

The Standard Natural History. Six volumes, imperial octavo, illustrated. Edited by J. S. Kingsley, and written by the leading American authorities. Bradlee Whidden, publisher, 41 Arch Street, Boston, Mass.

This magnificent work, which is intended to give a popular account of the whole animal kingdom, is well worthy of the universal praise which has been bestowed upon it by naturalists and others. The leading American specialists in each department have contributed to it, and all seem to have carefully avoided the extremes of being either too abstruse for popular use, or too popular in style to be scientifically exact. The illustrations are remarkably clear and fine. In fact, one of its most prominent characteristics is its adaptability to all classes of readers; and every one interested in this fascinating department of natural science will do well to address the publishers for full particulars.

The *Columbia Bicycle Calendar*, just issued by the Pope Manufacturing Company of Boston, is an artistic and elegant work in chromo-lithography and letter-press. Each day of the year is given upon a separate slip, with a cycling quotation, newsy, of information, or otherwise interesting.

The favorite *Physicians' Visiting-List*, Blakiston's, has been received for 1887. Among the new features are disinfectants and disinfecting, examination of the urine, list of standard reference-books, incompatibles, and a cash-account.

It is arranged for 25, 50, 75, and 100 patients per day or week, interleaved and plain, dated and undated. Prices range from $1 to $3. It is published by P. Blakiston, Son, & Co., 1012 Walnut Street, Philadelphia.

Pamphlets, etc., received: *The Science Series: a Weekly Magazine of Natural Science*, H. M. Downs, Rutland, Vt.; *Interstate Monthly Readers*, Interstate Publishing Company, Boston; *Report on Powdered Anthracite and Gas Fuel* to the Scranton (Penn.) Board of Trade; *Preliminary Analysis of the Leaves of Juglans Nigra*, by L. J. Martin; *On an Old Portrait of Audubon*, by R. W. Shufeldt; *Iodine in Blowpiping*, by H. A. Wheeler and C. Luedeking; *Laryngology and its Cognate Branches in America* and *The Simplest and most Efficient Treatment of Diphtheria*, by W. H. Daly, M.D.; *Address* in State Medicine, by John H. Rauch, M.D.; *Proceedings of the Society for the Promotion of Agricultural Science*, edited by William R. Lazenby; *Publications of the Illinois State Board of Health*; and *Reports of the Agricultural Experiment-Stations of Connecticut and Wisconsin.*

Medicine and Pharmacy.

SOME FACTS CONCERNING COLOR-BLINDNESS.

A good deal of attention has been recently given to the subject of color-blindness, chiefly through the efforts of Dr. B. Joy Jeffries, whose investigations and practical suggestions have been of great value to the public, and to whose manual, *Color-Blindness: its Dangers and its Detection*, we are indebted for many of the facts here given. Although the defect now generally known as color-blindness must have existed from the earliest time, yet it is only about one hundred years since any theory was formulated. In 1777 Mr. Huddart reported the case of the shoemaker Harris, in 1779 Mr. J. Scott described his own case, and in 1794 Dalton gave so thorough an analysis of his own case that the attention of the scientific world was drawn to it; but it was not until Holmgren forced attention to the practical importance of the visual defect, in 1877, that the subject received the sanction of the general public. Holmgren reduced the tests for the defect to a simple and very practical system, and his methods form the basis of investigation.

The different kinds of color-blindness are grouped as *red*, *green*, and *violet* blindness. Violet, or blue-yellow, blindness is so rare, that the term "color-blindness" means generally, as now used, *red* or *green* blindness. Thus, the red-blind sees all objects of this color of a darker hue than they are. The same is true of the green-blind as to green. Both confound these colors with each other and with gray. Total color-blindness is that condition in which no color is seen, and cases of this kind have been tested and recorded. To persons thus affected, all colored objects are only shades of gray, or black and white. Wilson estimates that one person in twenty-five is color-blind, and this is not an exaggerated conclusion; whenever large groups of people are taken, as in schools of two or three hundred, it is found that the defect exists in males in large excess. In two hundred thousand examinations, it was found that color-blindness, in a greater or less degree, was four per cent of males, and one-fourth of one per cent of females.

Various causes have been attributed to this visual defect, such as congenital or hereditary conditions, the effects of civilization, education, social condition, and race differences. These, of course, modify the defect; but the actual cause has not been very satisfactorily explained. Incidental causes may arise, as accident or disease, and the use of tobacco and alcohol.

The usual mode of testing for color-blindness is by means of the Berlin worsted, which comes in all possible spectral colors, and in all shades of these colors. The advantages in using this worsted are, that it is evenly colored on all sides, has no reflection, is soft and easily handled, and always ready for use. These worsteds are done up in little skeins of uniform size and appearance. The colors are

red, orange, yellow-green, pure green, blue-green, blue, violet, purple, pink, brown, gray, several shades of each color, and at least five gradations of each tint, from the deepest to the lightest. A piece of white cloth is spread out in a good light, and the worsteds loosely piled together. The test-color is placed at one side, and the person examined is simply asked to select and place by the side of it the other skeins of the same color, lighter or darker. No color *names* are to be used. The green skein is laid at one side of the general heap. The normal-eyed will readily pick out all the greens of all shades. The color-blind will, *besides the greens*, or without them, select gray, stone-color, brownish-red, pale red, and full red. A person fully color-blind will be likely to select the red of a luminosity similar to that of the test-green. Another class, of a feeble chromatic sense, will not select hastily: they will hesitate over the lighter shades of them, and be in doubt whether they should go over or not. Perhaps they will throw in a pale-gray or very light brown, and then withdraw it. Where color-blindness is a source of danger, these are the worst cases. Another test is to select from the worsteds a purple rose-color. The examined is to select all lighter shades of this color, which the normal-eyed will do most readily; but the color-blind will select colors from pale blue to dark green.

In the red test the red-blind will choose colors varying from blue-green to reddish-brown.

The practical value of these tests has been clearly illustrated, by Dr. Jeffries and others, by showing the danger of employing the color-blind in positions where colored lights are used as danger-signals. In the marine service and upon railroads these signals are of vital importance; and, since attention has been scientifically given to the subject, it has been found that many of the employees in government service were color-blind, and unable to detect the colors of the danger-signals along the coast. Upon our railroads the same condition of things was apparent; and many old employees have been dismissed, or transferred to other positions, because of the defect. Of course, all candidates for these positions are now subjected to examination; and the tests that have been indicated are given, in order to secure safety in the service. The red skein used in the test corresponds to the color of the danger-signal of the marine and railroad service.

The whole subject is full of interest, not only in its practical application, but also to the curious investigator. A very interesting pastime can be afforded by testing for color-blindness among your friends, by the use of the Berlin worsteds. It is important that a proper selection of worsteds be made, and these can be obtained at any first-class establishment where worsteds are a specialty. The experiment should be made by daylight, as the test colors present a somewhat different appearance by artificial light.

MEDICINE A PROFESSION, NOT A TRADE.

The practice of medicine is one of the most noble and useful callings that men engage in. Even those persons who will not admit the usefulness of lawyers or clergymen to the community, find that the services of a physician are indispensable. From the hour of birth to that of death he watches over our life and well-being; and fortunate is he who has for his medical adviser a skilful, wise, and conscientious man, of which the profession contains so many examples.

The high social position which, in this country at least, is held by physicians, and the large pecuniary returns which they are popularly supposed to enjoy, lead many to enter upon a course of medical study who have no special aptitude for, or enjoyment of, the work. It is estimated that over forty thousand students have received the degree of M.D. during the past ten years, — a number out of al proportion with that required by the natural increase of population. Room must be made for all these new doctors, and so they crowd into the already over-filled ranks.

Although no man is fit to be a doctor who has not a true love of his profession, and who is unwilling to undergo the labors and privations for the sake of science and humanity alone, yet those cases are few where the physician is not dependent upon his practice for his entire support. In this respect he is on an equality with the mechanic or laborer, and his skill is subject to the same laws of supply and demand. In fact, in one respect he is less privileged than they; for, while they claim the privilege of "striking" if the work or wages are unsatisfactory, the conscientious physician feels bound to answer all calls upon his time and skill, even if he knows his patients to belong to that rather numerous class who make a practice of "paying their honest debts" before settling the doctor's bill.

And yet, to one not belonging to the profession, it seems as if, in many instances, the excessive competition had engendered a somewhat selfish feeling, and a spirit allied to that of the trade-union, in place of a broad and generous policy worthy of the high calling of a physician. We find many medical journals almost entirely devoted to the furtherance of exclusive medical associations, to the "regulation of medical practice" by the State, and the establishment of State or National "Boards," with legal power to say who shall or shall not practise. The suppression of the multitudinous quacks would be a public blessing; but when it is left to men whose income may be affected by their decision, to determine what amount of knowledge and skill separate the quack from the "regular," it is only human nature to draw the lines more closely than the best interests of science or the well-being of the community would justify, and they may even infringe upon the most important matter of individual personal liberty. Many of the most valuable discoveries in medicine and surgery have been made by those who under the medical laws of certain States would not be permitted to make use of their knowledge; and to such an extent is this carried in some cases, that Professor Pasteur is forbidden by French law to personally inoculate his patients with the hydrophobic virus, and is obliged to employ an assistant, possessed of the necessary medical diploma, to wield the hypodermic syringe. Truly this is a *reductio ad absurdum* of the principle of State supervision which we have no desire to see carried out in this country. It is greatly to the honor of the profession in the United States that so few cases of actual injustice have been reported.

A recent article in an English medical journal occupied a column or more in discussing the momentous question as to which should enter the patient's apartment first, the regular attendant or the physician called in consultation. In the serious cases where a consultation is necessary, it would seem more appropriate to consider the condition of the patient, and not waste time, in the presence of a suffering fellow-creature, in debating trifling and unimportant points of etiquette. With an attendant and consultant such as is assumed by the writer of the article above referred to, the lay reader may perhaps be pardoned if the similitude of the "upper and nether millstone" is suggested to his mind in connection with the effect of their visit upon the sick man.

We find in another journal the following opinion by a professor of medical jurisprudence: —

> A physician is, of course, completely at liberty to establish a standard of charges as high as he pleases; and he may make it so high that none but millionnaires will be able to employ him. But for a doctor deliberately to add to his usual rate of charges an amount based simply upon the supposed ability of his patient to pay, seems to me to be lowering your profession to the level of soulless usurers, and sacrificing all that is high and noble and philanthropic in it to the mere love of lucre.

The view here advanced is eminently just and sensible; but does it not indicate that the practice of adjusting their charges with regard to the assumed financial condition of the patient, rather than to the value of the services rendered, is not unknown among physicians?

These views are not brought forward with any intention of reflecting upon the members of a noble and useful profession. The physician's calling is a laborious, and in many instances a most disagreeable one, and no one is more justly entitled to his fees; but, as far as the physician's services are given for pecuniary reward, so far is his business dependent upon the well-known economic laws of wages. If the *laissez faire* principle is best for the bricklayer or carpenter, it is none the less so for the physician or apothecary. The builders' trade is not limited by law, but the courts do not hesitate to punish the man who knowingly erects an unsafe structure. And, even if the skill of a doctor was not determined by an official examination, there would be no difficulty in punishing cases of malpractice. The remarks of Dr. S. S. Wallian, in an article on patent medicines (*Philadelphia Medical Times*,

Oct. 16), seem to show that similar views are not confined to persons outside the profession. He says: —

When practitioners everywhere conclude to spend more time and effort in disseminating . . . axiomatic truths, than in traducing competitors or wrangling over medical politics, there will be less money poured into the coffers of the wily patent-medicine sharks, less quackery both in and out of the profession, and the medical millennium will draw nigh.

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ELECTRICITY AND HYGIENE.

If the present age is not to be called the "age of electricity," we may be sure that the next will be so designated; for, marvellous as are its developments in our day, electrical science is evidently as yet only in its infancy, and the extraordinary achievements which we are permitted to witness will undoubtedly be thrown far into the shade by those which our children are destined to see.

It is interesting to notice that many of the discoveries and inventions connected with the industrial application of electricity are not only valuable because they economize human labor or make it more remunerative, but are also advantageous from a hygienic point of view. Sanitary science may claim electricity as an ally and helper even now, with the prospect of increasing benefit from the affiliation in the future.

A year or more ago we referred in the *News* to the interesting discovery, in England, that a discharge of electric sparks through an atmosphere laden with dust has the effect of causing the dust to settle. It was at once conjectured that practical application of the fact could be made; and, as we then stated, the experiment was tried on the large scale in a lead-smelting establishment in Wales, in order to get rid of the deleterious fumes from the furnaces. These fumes consist of volatilized lead, or an impalpable dust of the metal, and it has been found impossible to free the air entirely from them by the use of the condensing flues employed for the purpose. The discharge of electric sparks in the flues, however, appeared to cause a complete deposition of the poisonous dust, and at the time when our article was written it had been decided to test the new method in all the flues of the establishment, their total length being more than two miles. We have seen no account of the results; but whether these have been perfectly successful or not, there can be little doubt that the discovery of this peculiar action of electricity is one that in the long run will prove to have important sanitary as well as industrial applications.

The reference to dust reminds us of another use of electricity, which has indirectly been the means of preventing dust in flour-mills; namely, the electrical sifting-machine. The jerky motions formerly given to the sifter, in order to separate the flour from the bran, filled the air with a fine dust, which was injurious to the health of the workmen, and which also, from its extreme inflammability, greatly increased the risk of fire in the mills. The electrical sifter, of which our limits do not permit a detailed description, entirely obviates this difficulty and danger.

Electricity is also of inestimable value as a means of saving life in mines. Formerly scores of miners met their death because the fuse employed in blasting burned too quickly, so that they had not time to reach a place of safety before the explosion; or, if it burned too slowly, they often supposed it had gone out, and, on approaching to put another fuse in its place, were surprised by the delayed discharge. Electricity induces the explosion at the precise moment desired, as in the famous blowing-up of the rocks in Hell Gate; and, if it fails, the locality can be approached without danger, as no discharge is possible until the electrical connection has been repaired.

A curious use has been made of electricity in the manufacture of alcohol from beet-sugar refuse in France. As formerly obtained, the alcohol was liable to be contaminated with the higher alcohols, which render it both unpalatable and dangerous to health. Two French inventors have therefore devised an electrical apparatus by means of which a certain number of molecules of hydrogen are added to these noxious alcohols, so that the distilled product is completely freed from their presence. Beverages prepared from the alcohol thus obtained are thus preserved from at least one deleterious admixture, and public health is so far the gainer.

The introduction of the electric light is also to be encouraged on hygienic grounds. Whether the light is in some cases injurious to the eyes, is not fully settled; but if this be the case, it is to be regarded as a disadvantage incident to the present rudimental state of the enterprise, and sure to be obviated by improved appliances. Meanwhile, we know that the use of the new light in churches, public halls, theatres, and similar places of assembly, has been of immense advantage to the purity of the air, hitherto vitiated by the combustion of gas, oil, and kindred agents that depend on atmospheric oxygen for their illuminating power. We have recently seen in some foreign journal the report of experiments made in Munich for determining the amount of carbonic acid in the air of theatres lighted by electricity and by gas; and, as might have been expected, the proportion of the objectionable compound was far greater where gas was used. No doubt many of our readers have noticed that the air in a large room lighted by electricity is both purer and cooler than in one lighted by gas or oil.

We might add many other illustrations of the sanitary and hygienic gain that is due to the increased use of electricity in the arts, — in electroplating, for instance, where the battery process takes the place of the old gilding and silvering by the aid of mercury, which was highly injurious to the health of workmen, — but the examples already given will suffice for our present purpose, which was simply to show that this mighty force, of which a few generations ago the destroying thunderbolt was the familiar and almost the only type or symbol, is becoming one of the most beneficent of sanitary agents, and not merely a useful slave in doing work for us and helping to fill our coffers.

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MONTHLY SUMMARY OF MEDICAL PROGRESS.

COMPILED EXPRESSLY FOR THE SCIENCE NEWS BY W. S. WELLS, M.D.

At the late French Surgical Congress a paper was read by M. Thiriar, on "The Urine in Abdominal Surgery."

He considered that a very important diagnostic sign is afforded by the *quantity of urea* in the urine passed during the twenty-four hours by patients with abdominal tumors.

After frequent and patient experiments, he had been able to conclude as to the characters of the abdominal tumor, whether benign or malignant, from the amount of urea present.

When the tumor was benignant, the average of the urea secreted in the twenty-four hours varied from fifteen to twenty-five grams (℥ iv–℥ vij), but was never under twelve grams (℥ iii).

On the contrary, when the tumor was malignant, the amount of urea was always below twelve grams.

He gave the history of a woman brought to him, said to be suffering from an ovarian cyst, which was quite correct; but, upon examining the urine, so small a quantity of urea was found as to excite suspicion of a malignant growth.

The operation for removal of the cyst was proceeded with; and, in confirmation of the suspicion, behind the cyst a cancerous growth was found.

This means of diagnosing the nature of tumors within the abdomen, if confirmed by the experience of others, will prove of great practical importance.

A rival of cocaine is described in an Australian medical journal. It is an alkaloid derived from the *Euphorbia Drummondii*, a plant which grows plentifully in the neighborhood of Port Germain, Australia; and Dr. Reid of that town gives the new local anæsthetic the name of "drumine." Dr. Reid believes this drug will be found a valuable adjuvant in the treatment of many painful affections.

M. Polaillon relates the case of a man who had swallowed an iron fork, and M. Trouvé experimented with an electro-magnet, with the view of diagnosis.

The magnetic needle was deflected by the approach of the patient, and a large electro-magnet caused a slight arched projection of the surface of the abdomen over the region of the stomach, as if something were inside, and pressing the organ outwards.

Gastrotomy, or an opening into the stomach, was performed, and the fork was removed. It measured twenty-one centimeters.

The wound of the stomach was sutured, and the organ was returned, and left free in the abdomen, after which the external wound was also closed and treated.

It is indeed a triumph of science which enables the presence of a tumor in the substance of the brain to be not only diagnosed, but its exact location so clearly determined by the symptoms, that the surgeon confidently operates to remove it, and finds his confidence rewarded by the restoration of the patient to health.

The English medical journals report the fourth case of the successful excision of a tumor in the brain.

The patient was a man who had suffered terrible pain in t e head, with occasional convulsions, and had been absolutely paralyzed on one side of his body for a month, and had passed into a semi-comatose condition.

Mr. Victor Horsley trephined over the region of the brain indicated, — the motor region of the right hemisphere, — and, after enlarging the opening in the skull made by the trephine, removed a tumor from the brain.

The tumor weighed four ounces and a half, and was three inches broad by two inches deep.

On the day after the operation the patient was perfectly rational, and even lively in his conversation, and quite free from pain.

On the fourth day after the operation the wound was entirely healed, and the man had recovered some power in the paralyzed leg.

The history of the three other cases in which Mr. Horsley has operated successfully on the *motor area of the cortex of the brain*, was given to the Section of Surgery at the meeting of the Association at Brighton, and will be shortly published.

It may be interesting to anti-vivisectionists to know that not only have the facts upon which the diagnosis of the seat of the lesion or disease in these cases rests, been discovered by experiments on lower animals, but that the details of treatment have also been worked out in the course of these experiments.

A Russian medical journal relates cases of the bites of rabid animals successfully treated by cantharides, the Spanish fly, familiar to those who have been blistered in the old-fashioned way.

A wolf attacked three men, inflicting on one a large and deep wound in the left groin, tearing off a piece of skin several square inches in area.

The other men were wounded in the face, legs, and arms. It is well known to the profession that the bites of mad wolves are more dangerous than those of mad dogs, which is partly accounted for by the greater ferocity of the wolf, even when not rabid, and the more extensive wounds thereby resulting.

Cantharides plasters were applied to all the wounds, and powdered cantharides was given internally in three-grain doses, daily, to each of the three patients.

The internal administration was continued for a week, until the patients complained of some urethral heat and irritation.

Seven months have passed, and all the patients remain perfectly healthy.

The author, however, is familiar with the fact, that a large proportion of persons bitten by rabid animals escape hydrophobia, even when no treatment is adopted. He is, therefore, careful not to claim in this treatment a specific, and accordingly awaits developments.

Dr. Brown-Séquard has contributed a paper to the Société de Biologie on "Catching Cold," and its prevention.

Under the name of a "cold" are included a number of acute catarrhal inflammations, affecting the nasal, pharyngeal, laryngeal, tracheal, or bronchial mucous membrane.

Dr. Brown-Séquard considers the neck and feet to be the specially sensitive parts, — the so-called "catarrhal-genetic areas."

To prevent "colds," the plan is simple. One has only to harden these areas, and destroy their sensitiveness.

This is done by daily blowing a stream of cold air, by means of a bellows or elastic bag, upon the neck, and by immersing the feet in cold water.

The air is at first only slightly cool, but is each day made colder, until the neck can stand an arctic blast or blizzard.

The water in which the feet are immersed is also made colder daily, starting with 90° F., and gradually reducing to 38° F.

A Russian medical journal gives details of two cases occurring in soldiers, one of whom accidentally cut away, with an axe, the second phalanx of his right forefinger; the other, in a similar way, had severed the second phalanx of his left thumb.

In the first case the finger held by a strip of skin, but in the second the chopped-off part was brought away in a glove. In both cases the cut was clean, without any crushing of the parts. The first man was seen by the doctor two hours after the accident, the second three hours.

The wounds were washed with regulation antiseptic washes, and the severed parts accurately fixed by sutures in their normal situations, after which an iodoform dressing was applied.

In both cases perfect union by the first intention ensued, with return of sensation and limited motion.

These cases confirm the propriety of re-adjusting parts cut away, and maintaining their temperature until union takes place. They should be held on for hours by hand, until the surgeon arrives to secure them by adhesive strips, sutures, bandages, or other means, as required.

If warm water is at hand, a cloth moistened in it, and applied to maintain the heat in the severed parts, will encourage re-establishment of the circulation.

A remarkable case of injury to the finger is given by M. Thomas of Tours, and described to the Paris Society of Surgeons.

One of his patients, climbing over an iron railing with sharp-pointed tops, when dropping down, felt himself hung by one of his fingers, caught, by means of a ring on it, between the rails.

The resistance soon gave way, and he dropped down, and, going to his room, found that his finger was completely stripped of flesh. Search was made, and the fleshy part of the finger was found caught with the ring on the railing.

It presented the unique appearance of a fleshy sheath.

An hour afterward M. Thomas arrived, and reintroduced the bone of the finger into its natural fleshy covering, applied a couple of stitches, and bandaged the parts.

The extreme end of the finger, however, became gangrenous; but the patient had the benefit, from the replacing of the detached flesh, of saving nearly the entire finger: and it is very probable the whole finger would have been saved if the parts had been adjusted as soon as the fleshy covering was found, instead of waiting an hour.

Another example of conservative surgery is recorded in the case of a man who caught the second phalanx of his middle finger between the cog-wheels of a machine in motion, crushing the bone and flesh into a shapeless mass.

The surgeon cut away the destroyed phalanx of the finger, and brought together the clean-cut surfaces of the first and third phalanxes, sutured them in apposition, dressed the now shortened finger with splints, and put the arm in a sling. In time the man had entire use of it.

A French journal devoted to diseases of the skin, relates several cases of psoriasis caused by fright and mental emotion.

The distinguished German surgeon Volkmann of Halle, has been created a noble by the King of Prussia.

HOW TO TAKE MEDICINE.

Bitter tonics, as quinine, should be taken half an hour before meals; iron, oils, and acids after eating, that they may be digested with the food. Iodide of potassium is always given after meals; it is said then to be less liable to disorder the digestion. When a tonic is ordered to be taken "three times a day," the doctor should be asked whether it is to be given before or after meals. In severe cases of illness it means once in eight hours, for day and night are alike then to nurse and patient. Where medicine is to be given at short intervals, — every fifteen minutes or half-hour, — it must be prepared, and ready to give at the exact moment fixed upon. A list should be made of the times at which it is due, and each checked off as it passes; thus the nurse is sure that no dose has been omitted. The doctor should always be asked whether the sick person is to be wakened to take medicine: sometimes sleep is the more important of the two. When children are very ill, if giving the medicine involves great excitement, struggles, and tears, the doctor should be told of it, as he may consider that the fatigue and reaction will do more harm than the remedy could do good, and discontinue it, or substitute something in its place. When powerful medicine is being used, of which an overdose would be fatal, the nurse should make it a rule to read the directions at each time of using, and to measure the dose twice. The label on the bottle should always be read, even when one is sure that one is right, to prevent mistakes. It forms a habit of caution which is of incalculable value, and may prevent lifelong remorse. Liniments and outward applications should be kept in a place by themselves. When a sedative is given, the room should be darkened, and kept perfectly quiet. The sufferer should lie on the right side, and try to sleep. The nurse must take care that the feet are warm, and the bed-covering comfortably arranged. When there are noises in the street or in the house that cannot be controlled, a piece of cotton-wool pressed tightly into each ear will obviate the difficulty as far as the patient is concerned, and insure the necessary stillness. — Elizabeth Robinson Scovil *in Good Housekeeping, Holyoke, Mass.*

INFANT DIETETICS.

Editors Science News:

It is generally admitted by physicians that saliva in the human infant is not secreted until the age of six months. Consequently all starchy food is forbidden until after that period. Every practising physician, in his directions for feeding babies, follows this rule, and very properly, for it is founded upon a scientific basis. Whilst never deviating from this method of infant alimentation, I have encountered in my practice many instances in which babies *under* the age of *six months* were fed upon cracker-food, as the mothers called it. This cracker-food is prepared by grating finely two crackers and enough boiling water poured on them to fill an ordinary nursing-bottle; this is sweetened, and given to the baby when milk-warm. We do not advise this manner of feeding infants, but merely give it as an instance in which the rules of alimentation are not applicable to some babies. For many years, in ordering cow's milk for infants after the age of one month, we have used *pure* milk. We have found that the little ones thrive better, are less subject to colic, and consequently less troublesome, which is an important point with mothers who have many household cares. How often have we been called to see babies who were restless, fretful, and puny, with no sign of the growth a healthy baby should show, and found that the little ones were literally starved, being fed upon milk and water, and

who, upon being placed upon a diet of pure milk, have in a few months grown fat and healthy. We owe this hint on baby-feeding to Dr. Hiram Corson of Plymouth, Penn. Another point in the feeding of babies is the temperature of the food. After three months we give the food at the temperature of the room. If in winter, it is well to let the food remain in the room until needed. Milk is rarely if ever given of the same temperature as the mother's milk; it is either too warm or too cold. During the night in winter it is well to place a bottle of food under the pillow: it is then sufficiently warm to be given the baby.

R. R. BUNTING, M.D.

PHILADELPHIA, *December*, 1886.

MEDICAL MEMORANDA.

TREATMENT OF FRECKLES WITH CARBOLIC ACID. — Dr. Halkin's procedure is as follows: The skin, being washed and dried, is put on the stretch with two fingers of the left hand, and a drop of pure carbolic acid is applied, exactly over the patch. When it dries, the operation is completed. The skin becomes white, and the slight sensation of burning disappears in a few minutes The thin crust which forms after the cauterization should not be disturbed: it detaches itself spontaneously in eight or ten days, leaving a rosy coloration, which is soon replaced by the normal color of the skin.

WHAT IS QUACKERY? — In a lecture delivered at King's College Hospital, Dr. Burney Yeo quotes the saying of a clever lady as a warning to those who use the word "quackery" too freely: "Why,' said she, "am I told that every thing that does me any good is 'quackery,' and that the only thing that is not 'quackery' is taking nasty medicines which do me *no* good?"

THE DOCTOR AS A MISSIONARY. — Dr. P. Cullen, surgeon-major in the British Indian Service, says that, since vaccination has become general in the region of India where he is now stationed, the village gods, to which the country people made pilgrimages for protection, have become unpopular, hardly a local deity being now maintained. This is a point of conflict between science and religion which the most orthodox will not disallow.

CREMATION IN HOLLAND. — The Rotterdam section of the Dutch Cremation Society has determined to petition the government to remove the legal difficulties which now staud in the way of incineration of the dead, in order, they say, that the inhabitants of Holland may enjoy the same privileges as those of other countries.

DEATHS FROM ANÆSTHETICS IN ENGLAND. — During the year 1885 twelve deaths were reported in England from chloroform, and three from ether. None is known to have occurred from any other anæsthetic.

DEATH FROM THE STING OF A WASP. — At an inquest held not long ago at Bath, Eng., respecting the death of an old lady, it was found that she had died from the results of a wasp-sting.

AN EXCELLENT SYSTEM. — A very beneficent action is now required by law in Germany and Switzerland, by which holidays are obligatory in all public and private schools when the temperature reaches a certain height. These heat-holidays are called *hitzferien*, and are worthy of adoption in other schools. In Basle new regulations have just been issued concerning heat-holidays. When the temperature rises to seventy-seven degrees in the shade at ten o'clock in the morning, holiday is to be proclaimed to the scholars until the afternoon. Two such holidays were proclaimed during a recent hot week, to the no small delight of the boys and girls, whose jubilant greeting of the announcement could be heard from the open windows of the gymnasium.

LABELS. — In order to render paper labels durable, the name, etc., should be written with Chinese ink, and the label, after fixing, sized twice with a solution of gelatine or good glue. It should then have two coats of copal varnish. Labels treated in this way will last for years. If a label is required which can be read by transmitted light, nothing is simpler or more efficient than ordinary black varnish, which can be applied with a pen or camel's-hair brush. After some time the varnish may show a tendency to chip off, but it can easily be renewed. For bottles containing acids or caustic alkalies, the varnish is in all cases much better than paper labels.

THE ADMINISTRATION OF COD-LIVER OIL. — Dr. W. Washburn of New York City writes that he has long been in the habit of administering cod-liver oil in milk to both infants and adults. Milk is taken in the mouth, and held there; and the spoon is first dipped in milk, and then the oil poured into it. Just as the oil is taken into the mouth, the milk should be swallowed, and another sip of milk taken. Children, if interrupted in nursing, readily swallow a teaspoonful of oil, and then proceed with nursing as if nothing had happened. The oily nature of the milk seems completely to shield the mucous membrane of the mouth and throat from contact with the cod-liver oil.

PHYSIOLOGICAL CLOTHING. — Dr. Lopez of Philadelphia says that a boy's jacket or overcoat should have what is called breast-pockets; the opening should be high, and as far back as possible, parallel with and in the line of the body, instead of low down and transverse, as usually found in the ordinary jacket or overcoat. The pants should have what are called hip-pockets, and no others. It will then be apparent, that, whilst the hands are in the pockets, a better, if not a perfect, position will be assumed, and the boy spared the many admonitions to keep his hands out of his pockets, and the accompanying box on the ear.

"HUMORS."

IN an examination on physiology some years ago at South Kensington, the question was put, "What is bile? and what are its uses?" One candidate's answer was, "Bile is formed in the stomach, and is used for cleaning carpets."

TAKING PILLS. — Doctor. — "Well, Pat, have you taken that box of pills I sent you?" Pat. — "Yes, sur, be jabers, I have; but I don't feel any better. Maybe the lid hasn't come off yet."

A DEATH certificate returned to the proper authorities by a Cincinnati physician gives the cause of death as follows: "She dide with Liver dease & New Monei."

A NEW DRUG. — A written order for "grocer's supplement" was recently presented at a drug-store in a neighboring city, and promptly filled with a quantity of corrosive sublimate.

SERVANT (to drug-clerk): "Oi want twinty-foive cints worth of powder." Drug-clerk: "What kind of powder? face powder?" Servant: "Oi don't know, sorr." Drug-clerk: "Who is it for?" Servant: "It's for Mrs. Hendricks, the lady what kapes the boarding-house beyant the corner." Drug-clerk: "Oh, yes. I used to board with Mrs. Hendricks myself. She wants insect-powder."

REVISED PROVERBS. — The *Medical Record* makes the following modifications of ancient saws, to suit the times: "What can't be cured must be regularly treated at the regular rates," "A cut in time saves nine," "Ambulances alter cases."

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SETH C. BASSETT,
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Publishers' Column.

ALFRED R. WALLACE, LL.D., the well-known English naturalist, will lecture in the United States during the winter and spring. For prospectus of lectures and terms, application must be made to his agent, B. W. Williams, 258 Washington Street, Boston, Mass.

To endure is greater than to dare; but why endure a bad pen, when Esterbrook's superior and standard steel pens are within the easy reach of all, being sold everywhere?

DR. WATERS'S FLESH-BRUSH is just the thing to arouse the circulation on these cold winter mornings.

DR. DAVID CLARK, Springfield, Mass., says: "HORSFORD'S ACID PHOSPHATE" is the only proprietary medicine I ever use or prescribe."

THE continually increasing sales of IMPERIAL GRANUM are a sure indication of its superior character. It is indorsed by many physicians.

RECENT improvements in the manufacture of HYDROLEINE have rendered the emulsion even more stable than before, and it now retains its permanency under the most extreme conditions of temperature.

ICE produced by the artificial process is rapidly supplanting, in tropical climates, that cut from Northern streams and ponds, and transported at great expense. The machines manufactured by DAVID BOYLE of Chicago are the most economical and efficient in the market, and are in use in all parts of the country.

THE GURNEY SYSTEM OF HOT-WATER HEATING is rapidly coming into favor. The heat radiated from hot-water pipes is considered by many to be more agreeable than that from a hot-air furnace, and the temperature can be regulated much more easily than when steam is used. It seems to combine the advantages of both of the old systems.

HENRY CARMICHAEL, Ph.D., for many years professor of chemistry and physics in Bowdoin College, professor of chemistry in the Maine Medical School, assayer for the State of Maine, and lecturer and writer upon scientific topics, has recently removed to this city, and opened at 55 Kilby Street an analytical laboratory. Professor Carmichael is the inventor of pulp machines, and processes for rendering fibre-ware impervious, that have entered into extended use, and become the basis of a large industry. In addition to the customary work of an analyst, attention will be given to the application of science to the arts and to the improvement of chemical manufactures.

The Popular Science News

AND

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CONTENTS.

FAMILIAR SCIENCE. — The Centenary of Scheele 17
The Magnetic Chariots of China and Japan 17
Snow 18
Natural History Notes 18
The Carboniferous Era 18
The Climbing Fern 19
Curious Facts about Common Animals 19
Scientific Brevities 20

PRACTICAL CHEMISTRY AND THE ARTS. — An Early Form of Electric Motor 20
A Hydraulic Lift for Canal-Boats 21
Aniline Dyes in the East 21
How Arago Measured the Power of Steam 22
Industrial Memoranda 22

HOME, FARM, AND GARDEN. — The History of Cultivated Plants 22
A Centrifugal Milk-Tester 23
Baking-Powders 23
The English Sparrow 23
Selected Recipes 24
Gleanings 24

EDITORIAL. — The Cold 25
Astronomical Phenomena for February, 1887 26
Meteorology for December, 1886, with Partial Review of the Year 26
The Old Niagara Gorge 27
The Supposed Parasites of the House-Fly 27
Loons' Teeth 27
Test for Adulterated Butter 27
Questions and Answers 28
Literary Notes 28

MEDICINE AND PHARMACY. — Some Facts concerning the Human Brain and Mental Phenomena 28
The Effect of High Altitudes upon the Pulse 29
Explosive Medicines 29
Monthly Summary of Medical Progress 29
The Hygiene of Cycling 30
Digestion of Starch 30
Chronic Constipation 31
The Means of Preventing the Deterioration of Rubber Apparatus 31
Potassium Permanganate in Burns and Frost-Bite 31
Fees for Expert Testimony 31
The Purity of Mid-Atlantic Air 31
Arbor-Vita in Phosphuria 32
Medical Memoranda 32
Humors 32

PUBLISHERS' COLUMN 32

Familiar Science.

THE CENTENARY OF SCHEELE.

ONE hundred years ago on the 22d of last May the great Swedish chemist died at the little town of Koeping. He must be ranked, with Priestley, Cavendish, and Lavoisier, as one of the founders of modern chemistry, although none of his numerous discoveries were as important as those of the above-named chemists. His line of work was more general, as is shown by the long list of substances prepared and described by him for the first time.

Scheele was born at Stralsund on the 9th of December, 1742. His parents were poor, but were able to give him some education; and at the age of twelve he was apprenticed to an apothecary, with whom he remained six years. During this period the works of the chemist Neumann fell into his hands, which he read and studied, and developed a taste for chemistry, that doubtless had a great influence upon his future career.

After travelling through Sweden for several years, he returned to Stockholm, and shortly afterwards was employed in a pharmacy at Upsala; but, wishing more time to devote to his studies, he removed to Koeping, where he was employed by the widow of an apothecary to manage the shop of her former husband. Here he remained until his death, at the age of forty-three years, busily employed in his investigations, while his trade furnished him an income sufficient for his few wants.

His most important discovery was that of oxygen gas, which was made independently of that of Priestley, although a little later in point of time. In those days news travelled slowly, and Priestley himself admitted that Scheele was fairly entitled to divide the honors of the discovery with himself. In addition to oxygen, he discovered and prepared chlorine, aldehyde, and citric, gallic, mucic, lactic, and tartaric acids, and predicted the existence of the element fluorine, which was not isolated till one hundred years later. He also was the first to prepare and describe the properties of glycerine, and made so many discoveries of the special reactions for the separation of the different elements, that he must be considered as one of the chief founders of the modern system of quantitative analysis.

All of Scheele's investigations were carried on with the aid of the simplest forms of apparatus. The ordinary glassware of his little pharmacy was largely used for this purpose; and a few glass retorts and porcelain jars, with some bladders for collecting gases, formed the principal part of his equipment. But his enthusiasm for his favorite study was such, that, even under unfavorable conditions, and with limited resources, the poor apothecary in the obscure Swedish village made for himself a name that will always be remembered as long as chemistry is studied; and, if it had not been for his untimely death, he would doubtless have anticipated many discoveries of more recent date.

We are indebted to the publishers of the *Scientific American Supplement* for the accompanying portrait.

THE MAGNETIC CHARIOTS OF CHINA AND JAPAN.

THE Chinese, as is well known, claim to have been the inventors of the mariner's compass, which, they say, they first used 2634 B.C. A book recently published in Vienna gives some translations from ancient Chinese writings which support this claim, so far, at least, as to render it probable that the property of the magnetic needle to point north and south was known and made use of by the Celestials many years before it was introduced into Europe.

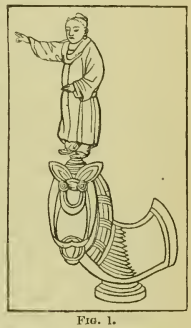

FIG. 1.

According to the tradition, a certain warrior, named Tschi-Yeu, possessed a war-chariot, upon which was placed the figure of a man with outstretched arm which always pointed to the south, — the direction of the magnetic needle in China, — no matter in what direction the chariot was proceeding. With the aid of this figure he was enabled to pursue his enemies into unknown regions, being always guided over the country by the little figure placed in front of his chariot.

Another tradition relates, that, in the year 1100 B.C., a prime minister, named Tscheu Kung, presented to some ambassadors from a foreign country five carriages, which were constructed so as to constantly indicate the south, and by means of which they were

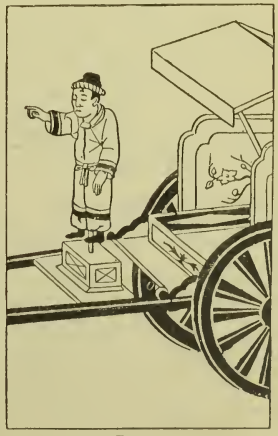

FIG. 2.

greatly aided in returning to their native country.

In more recent times (1609 A.D.) we find the magnetic statuette more fully described and illustrated in one of the Chinese encyclopædias. From the drawing, it is evident that the figure was directed by a magnet, or, more probably, a piece of natural loadstone concealed in its arm. How far the claims of the extreme antiquity of the invention can be sustained, is doubtful, for the mariner's compass was known in Europe several hundred years before the date of this drawing. Still, it is not unreasonable to suppose that the Chinese made the discovery at a very early period; and it doubtless was first suggested to them by the action of a piece of natural loadstone, or magnetic oxide of iron (Fe_3O_4), in always turning into the same position when suspended by a string or floating in water.

The Japanese claim to have introduced the magnetic carriages in the seventh century. Fig. 2 is taken from a Japanese encyclopædia, and represents a vehicle of this sort constructed by Chamen, a Buddhist priest, in the year 658 A.D. These magnetic figures were always preserved with the greatest care, and a special officer of the Emperor's guard was detailed to have charge of them. In the ceremonial processions they were placed in the front rank; and in time of war, when the fate of the whole army might depend upon them, special efforts were made to prevent their capture by the enemy. It is easy to imagine the value of such a device to an army traversing the steppes of Central Asia in an unfamiliar region, with the sun and stars obscured by clouds, and with no landmarks to guide it back to its native country; and the ignorant and superstitious Oriental soldiers must have looked upon these little images as possessed of almost divine power.

SNOW.

FROM a scientific point of view, there are many things connected with an ordinary snow-storm which are not generally known, and a brief description of a few of these may be of interest.

Snow-storms, in New England at least, often occur very suddenly. On retiring at night the sky may be clear, and the stars shining brightly; but on awakening in the morning the air is full of snow-flakes, and the roads obstructed with the newly fallen snow.

In a rain-storm, the water runs away as it falls, and the immense amount of solid matter precipitated is not so evident as when it remains on the ground in the form of snow. It will always be hard to understand how the thousands of tons of snow which fall in a single storm, can be suspended in the upper regions of the atmosphere. We know that snow is formed from the condensation and freezing of aqueous vapor, or steam; but, when we learn that every cubic foot of snow which falls is condensed from 1728 cubic feet of aqueous vapor, the amount necessary to form the snow of a single storm is almost beyond our powers of calculation.

In the condensation of snow from aqueous vapor, an immense amount of so-called latent heat is set free. In the condensation of a single pound of steam to water, enough heat is evolved to raise a pound of water from 0° to 972° Fahrenheit, and an additional amount of heat is given out when the water is frozen into snow or ice. It may be said that a fall of snow is equivalent to a fall of red-hot sand, as far as the heat produced in its formation is concerned; and although this heat may not produce any appreciable effect upon the temperature of the air at the surface of the earth, yet it shows the tremendous energy of the operations taking place in the upper air, and the enormous amount of cooling necessary to produce a single fall of rain or snow.

In calm weather, when the snow is falling gently, if we catch the flakes upon a piece of black cloth, and examine them with a magnifying-glass, we often find them to possess forms of wonderful beauty. They are generally star-shaped; and, on counting, we find that there are always six rays or points, or else some simple multiple of that number. If we measure the angles of the branching forms, we find that they always measure exactly sixty degrees; in other words, water crystallizes in the hexagonal system, one of the six great systems of crystallization, which includes the well-known mineral calcite or limestone. Like limestone, also, water is said to be dimorphous, sometimes crystallizing in the trimetric system; but this observation has not been fully confirmed. Snow is simply finely crystallized ice. When more coarsely crystallized, or in half-frozen drops of water, it is kuown as sleet. When precipitated in large masses of ice, we have hail-stones, the formation of which has never been satisfactorily explained. Probably nearly all of our readers are familiar with the appearance of the country when covered with a mantle of freshly fallen snow, but the few who reside in tropical countries may be assured that they have yet to witness one of the most beautiful manifestations of nature.

NATURAL HISTORY NOTES.

BY DR. S. F. LANDREY.

PART III.

THE old-fashioned, deep purple columbine of our grandmothers, the *Aquilegia vulgaris* of botany, has some remarkable properties. In its composition is found the poisonous alkaloid delphinia, but whether its intoxicating power is due to this alone is an unsolved question. The incurved spurs contain at the extreme distal end a honey-trove, or cell. Its sweetness is always perceptible when the saccharine drop can be procured. After this palatable drop of sweetness, the carder bumblebee (*Bombus muscorum*, Latr.) pushes his long proboscis into the honey-cell, and imbibes his morning dram. In a few minutes he drops to the ground in a kind of apoplectic condition, or sits stiffly on a leaf, like a chained Prometheus, unable to do more than resent teasing by protruding his sting, buzzing out a feeble complaint, or raising a foot in warning to his tormentor, and, when a little less intoxicated, will lie on his back on the ground, buzz, kick, sting, and fight like a tiger. Notwithstanding, he no sooner recovers his locomotion than "he seeks it yet again" and again. I first observed it in 1880, and it was fun for the boys to come and see the drunken bumblebees. Warm, dry days are best; for in wet weather it does not seem to affect them.

THERE are many reputed remedies for rattlesnake bites; but how few are reliable, the graveyards alone can tell. There is a rattlesnake grass (*Glyceria*); rattlesnake's master, a species of *Eryngo;* and a species of *Nabalus;* rattlesnake plantain; an orchid, the *Goodyera;* rattlesnake weed, a species of *Hieracium*, etc. The Sanicle is the only perfect natural remedy of which any one can be positive of its virtues. Of this there are only two well-known species in Indiana, *Sanicula Canadensis* and *Sanicula Marilandica*. A young man was bitten in the left foot by a "prairie black rattlesnake." A neighbor took the herb, pounded it, made three poultices of the bruised leaves alone, and applied at intervals of about fifteen minutes. The boy chewed some of the leaves, and swallowed the juice. The leaves turned black on the wound, and the boy's life was saved. The *S. Canadensis* was the plant used. I know of three persons who used the remedy, and all were cured. One of the parties was bitten twice. No one should think of trying to use it without knowing it botanically, as several poisonous plants resemble it closely. I have known whiskey to fail, and the Sanicle to cure.

THE observations of P. Mégnin on "The Supposed Parasites of the House-Fly," in the December number of the *Popular Science News*, proving the "adaptation to environment" of *Tyroglyphus scio*, by the change of its form to *Hypopus muscarum*, is suggestive of some changes witnessed in wild plants, and produced by change of soil, situation, and other environments. *Lobelia inflata* seed sown in my own garden, on the richest of ground, where had once been a mortar-bed and pile of sand, changed in the third year to an over-grown *Lobelia spicata*, of two to four feet in height. The whitish, pearly milk-glands at the points of the leaf serratures were visibly enlarged; the paniculate stems changed to strict and simple ones, except in the upper third of the stem; raceme long and naked; corolla four inches or more in length. None of the latter species grew anywhere in the neighborhood. A removal to a more clay-like soil restored the same perennial roots, the next year, to the annual *Lobelia inflata*. Likewise a pollen-crossed plant of the orange-flowered lily, and *Ixia Chinensis*, or blackberry lily, produced, in the third year, bluish-purple flowers, resembling those of the common blue-flag, proving conclusively, to my mind, at least, the blue-flag origin of the lily order of plants.

THE CARBONIFEROUS ERA.

PROFESSOR J. W. DAWSON has recently given a course of lectures upon geological subjects before the Lowell Institute of this city. His lecture on the formation of coal-beds, as reported in the *Boston Herald*, is of unusual interest. The physical conditions of the earth underwent, said the speaker, important changes at the time of the carboniferous age. Instead of the small, isolated island continents, large bodies of land came into existence. Vast flats or swamps were formed, extending for miles in the interior of these continents. Sometimes dry and again inundated, they were not dissimilar to our modern swamps. To these circumstances is due the formation of our coal-beds. During this age appeared the first land-animals of the vertebrate group; and a sketch was exhibited, giving an ideal carboniferous landscape, showing the forms of trees, plants, and animals then in existence. The variety of plant or tree known as the sigillaria was one of the leading forms of vegetation, and to this more than to any other one form of vegetation we owe our coal-beds. The sigillaria differed much from our modern trees. The bark was very thick, and the woody part became proportionally small. A specimeu of the tree itself was exhibited, through the courtesy of the Natural History Society. The roots extended long distances away from the trunk, this being a wise provision of nature, on account of the marshy and uncertain character of the soil. The roots are so regularly formed and branched, that they have now come to be considered more as underground branches. But one or two discoveries have been

made where the fruits of the sigillaria were intact with the remainder of the tree. On this account, some trouble has arisen in their botanical classification. Although the coal is due principally to the carbonization of sigillaria, its origin is not confined to this variety, for nearly every kind of vegetation entered into its creation. Clay seams are found to exist at the bottom of every coal-bed, and this fact furnishes a key to its accumulation. The clay is almost always of the bleached variety, and makes an especially good fire-clay, much resembling that found under the present swamps. It is pierced through and through with the roots of the then existing vegetation. The layer of coal above contains imprints of the limbs, bark, and leaves; and under the microscope certain small particles of naturally formed charcoal are revealed. At first the interiors of these continents where the coal-manufacture was going on were free from muddy waters, and the coal was correspondingly pure.

The lepidodendria were another important variety of vegetation in the carboniferous forests, as were also the calamites. These last exerted a most important influence in the formation of coal, and one which was of the utmost value. They much resembled our modern canebrakes, and are believed to have grown on the borders of the carboniferous forests, stretching far out like fringes, and acting as filters for the muddy waters, thus protecting the purity of the coal. It is a curious fact, that the pith of a plant, which decays first, is really the best preserved of all the parts. Decaying while the remainder of the plant is intact, its place is taken by loose sand, which forms a lasting core of sandstone, and is in time left alone; the remainder of the tree or plant forming, perhaps, a thin cylinder of coal, which is at last washed away and lost.

The vegetation of the carboniferous age was much more like the present vegetation of the warm Southern climates than any of the growths of to-day. In closing, Professor Dawson spoke of the immense debt we owe the carboniferous age for our coal, much over half of which is generously given to the United States and England. The production of coal in England has now reached 160,000,000 tons per annum, while the United States produces 100,000,000 tons, and the British colonies 5,000,000 per annum. Professor Huxley has curiously described our obligation in one of his papers on this subject. Nature, he said, is never in a hurry, keeping a thing until a use has been found for it. Her coal has been kept a million years. It was given to the sea, but no use was made of it. Exposed on the land, still no use was found for it until the other day, comparatively, when man, the last creature turned out, so to speak, made a fire, and found the black stone would burn. Coal is now essential to every thing. Without it metallurgical operations could not be carried on, and the great wealth of manufactories and railroads would not be in existence. Nature invested in the coal years ago, and now it is paid back, principal and interest. Professor Dawson's version of this would substitute for "nature," the "Author of nature."

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THE CLIMBING FERN.

"Lygodium Palmatum," or climbing fern, grows sparingly from Massachusetts southward. The stalks are dark brown, glossy, wiry, and brittle, and twine from ten to forty inches from delicate, creeping rootlets. The short alternate branches bear rounded heart-shaped palmately four to seven lobed sterile frondlets, the fertile frondlets above growing from five to eighteen inches long during July and September. It multiplies rapidly from rootlet as well as spore. It is an evergreen fern. Each year new rootlets creep out from under the ground four or five inches, covered with tiny curled-up frondlets, the one at the end ready to sprout into life in May as the old main stalk dies away.

In the low, moist, dense woodland adjacent to or upon the borders of the spagnum swamps, its growth is slow and fruitage rare; but wheu, through the woodsmau's axe, the sun shines upon the shy thing, it comes forth into new life, stretching out its rootlets below, and climbers above, wiuding itself, unlike most climbers, in either direction around the decayed twigs, underbrush, and the tall ferns: and in the autumn, when the frost comes, the evergreen fern is beautiful with its fruitage, in contrast with the glory of the foliage, and the bleached ferns. Later on it peeps above the wintry snow. Many attempts have been made to cultivate it in greenhouse and parlor, but without success: it pines for its native home; but with great kindness, and care in transplanting, it can be made to grow in open ground and rockeries. An allied species, the *Lygodium Scandens*, however, is easily grown in greenhouses.

Of late years it has been pressed and sold in

large quantities for decorative purposes, which means sacrilege to the botanist. But there is no danger of its being exterminated in this generation; it multiplies rapidly, and takes on new growth, strength, and beauty. But the march of improvement and the treacherous spark from the engine are fast laying low our noble forest-trees, the underbrush, the tall brakes, and ferns; and in the next generation our lowly twining, graceful evergreen fern may have become extinct.

W.

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CURIOUS FACTS ABOUT COMMON ANIMALS.

The lobster may be taken as a typical example of the crustacea. The segmentary or ring-like structure is very prominent. The legs of the animal are attached to the lower part of the thoracic segments. At the base of the legs or claws we find a little plume-like appendage, which represents the gills of fishes. These little bunches contain hundreds of ramifying tubes, by which the creature abstracts oxygen from the water. Each ring in the body has its pair of separate appendages, and the different segments of the body are analogous to one another. The rear segments of the body are modified into a flat fin or tail, by which the animal swims through the water, and are so powerful that he has been known to jump backwards a distance of fifteen feet. The ovaries of the lobster are commonly known as the "coral;" and the eggs, when extruded, adhere to the under side of the tail, which is covered with a viscid substance. In the eyes there are the proper arrangements for discerning light; and they are placed at the end of movable processes, which enables the animal to look in two directions at once.

The ears of the lobster are little open cavities, which are filled with water, and contain grains of sand. Sound undulations in the water cause these grains to jar against the hairs with which the ear is lined, producing a sensation analogous to sound; but the extent to which the seuse is developed is unknown. The lobster is the scavenger of the sea; and wherever any garbage or decaying matter is found, he is pretty sure to be present. But, before passing into his organization, the chemical composition of his food is so changed, that we need have no misgivings about enjoying our salads. They are very pugnacious, and in their battles frequently lose a claw or two, which shortly grow out again.

The crab has a structure analogous to the lobster, though apparently very different. Looking from above, we see only the shell; but on turning him over, we find the missing abdominal segments compressed or condensed together, and lying close up to the thorax. The crab casts his shell every year, the soft skin underneath gradually hardening into a new one. In this condition they are known as "soft-shell crabs," and considered a great table delicacy.

The hermit crab possesses the wonderful instinct of finding the cast-off shell of some other animal which he occupies. As their size increases, they move out of the old house, and start off in search of a better-fitting one. They sometimes find a desirable residence already occupied by another hermit crab, and then an amusing but desperate fight takes place ; and, if victorious, the house-hunter turns out the rightful occupaut, and snugly ensconces himself in the shell, while the evicted tenant must move on until he finds another one.

The barnacle, although resembling the mollusks, is properly classed as a crustacean. It has a soft body covered with a hard shell. It is provided with a set of hairy appendages, which, when all is quiet, are protruded from the mouth of the shell, and waved around in the water like an extended hand and fingers, gathering in food. This creature appears to be able to notice the approach of danger. If a person approaches a rock covered with them, he hears a slight, crackling sound, caused by the closing of hundreds of shells. The way in which they perceive the approach is not known. The backs of whales are often covered with these creatures; and it is supposed that the closing of the shells, upon the approach of the fishermen, gives warning to the animal, and enables him to avoid capture.

The horseshoe crab presents a curious difficulty of classification, some naturalists considering it related to the trilobites, one of the earliest forms of life, while others class it with the scorpions.

Insects are more highly organized than the crustacea, and are air-breathing animals. The grasshopper is a common and typical example of this class. He has compound eyes, made up of an innumerable number of facets. Under a microscope it resembles a piece of mosaic work. Each facet is a complete visual organ; and the grasshopper, looking at a blade of grass, for instance, actually sees several thousand. Probably, like the inversion of objects upon the human retina, continued practice enables the insect to judge correctly of the actual number.

The grasshopper, like other insects, breathes through openings in the side of his body ; from these openings, tubes known as *spiracles* extend with innumerable ramifications to all parts of his body. The air, passing through these tubes, comes into contact with the blood-vessels, and supplies

the blood with oxygen. These tubes can be easily found in the body of a fly or other insect, and examined under the microscope. A most wonderful circumstance connected with their structure is, that hey are lined on the inside with a sort of spiral spring, which coils around their entire length, strengthening them, and preventing them from collapsing. A similar arrangement has long been used to strengthen rubber gas-tubes.

The frothy substance which is often found on grass, and popularly known as "frog-spittle," has no connection with that animal. It is caused by a little insect which secretes a viscid, transparent fluid, with which he is completely covered. To enable him to breathe, he reaches out a pair of legs, and, enclosing a little bubble of air, brings it down, and afterwards allows it to escape into the liquid. After a while the numerous bubbles convert it completely into froth or a substance resembling saliva.

In spiders the head and thorax are bound together in one piece, and the abdomen connected to it by a very slender neck. Although spiders are provided with hollow poison-fangs, there is no proof that the American species, at least, are poisonous. The jaws of the smaller varieties are too delicate to take hold of the human flesh; and the probability is, that even the largest ones are entirely harmless. The female spider is the most important member of the family. The males are small and inconspicuous, and in one case a female was found amid the bodies of a large number of her unfortunate husbands, whom she had destroyed, and thrown to one side, — a perfect female Bluebeard.

The parental love of the spider is very strong. The female carries, suspended on her legs, a small bag containing the eggs, which resemble white-glass beads. If the bag is pushed away with a straw or stick, the creature will make the most desperate efforts to recover it. A spider was once found whose back appeared to have a granulated surface, but closer examination showed that she was entirely covered with her young. On trying to shake them off, they attached themselves to their mother by a thread; and on throwing her to the ground, she remained perfectly quiet until they had all pulled themselves back by means of their extemporized cable, and spread themselves over her body as before.

SCIENTIFIC BREVITIES.

Ozone. — Liquid ozone must be a highly interesting substance. MM. Hautefeuille and Chappuis have recently obtained it in the form of liquid drops of a deep indigo-blue color. The liquid could be kept nearly thirty minutes under a pressure of 75 atmospheres. Its vaporization is not very rapid even at atmospheric pressure. The liquefaction was effected by compressing, at about 125 atmospheres, a mixture of oxygen and ozone in one of M. Cailletet's tube-shaped vessels, which terminates above in a capillary part bent downwards. This descending part was exposed to a jet of liquid ethylene, a new method whereby M. Cailletet gets temperatures as low as —105° C. The blue coloration is very distinct in the cooled part. On releasing the pressure, the tube becomes instantly colorless; but a dark-blue liquid drop remains at the end. This liquid ozone may be examined either through liquid ethylene, or by momentarily removing the cooled tube from this liquid.

Cheap Sodium. — The manufacture of cheap sodium by an electrolytic process has been announced in France. An engineer of Lyons, M. Lossier, states that he will soon be in a position to sell sodium in large quantities at a price of about twenty-five centimes (five cents) per kilo., not much over two cents a pound. There would be no necessity for such an extremely low figure to be reached to insure a very large demand for the material. The process of M. Lossier consists, it appears, in decomposing, with an electric current, the chloride of sodium at a temperature of 900° C.; and it appears incredible, that, by any such process, the price named is not absurdly low.

"Alkali," according to an exchange, is a word of Arabic origin. The word *qalay* means "to fry," "to roast in a pan;" *al-qaliy* was applied to the calcined ashes of the plants salsola and salicornia. In early chemistry, says Dr. Murray, alkali was supposed to be a specific substance which existed, fixed (in soda, potash) and volatile (in ammonia). Duhamel (1736) showed that there were distinct alkalies: and these were distinguished as mineral alkali (soda), vegetable alkali (potash), and animal alkali (ammonia).

Acid Burns. — According to a writer in the *Chemical News*, the painful burn produced by nitric acid may be successfully treated by a dilute solution of sulphurous acid applied instantaneously.

Electrical Conductivity. — Professor Edlund contends that a vacuum is a good conductor of electricity. In a vacuum tube he distinguishes two resistances to the passage of the current: one is that of the column of rarefied gas, the other exists at the places of contact of the electrodes with the gas. As the gas is increasingly rarefied, the former decreases; but the latter increases, and at length becomes so great that the current cannot surmount the obstacle. Professor Edlund has furnished proof that this obstacle is due to an electro-motive force giving a current opposite in direction to the principal current. One evidence that a vacuum presents very little resistance to passage of electricity is, that, if electrodes be dispensed with, electric movements so considerable as to give light may be produced by induction at a distance, or by friction, in a tube in which the air is too rarefied to allow of a strong induction current passing between electrodes. The new view, if accepted, would require us to part with the conception that ordinary matter is necessary for propagation of electricity. Indeed, the various material substances are to be thought of merely as offering more or less resistance to that passage; their *rôle* is not active, but passive. The idea of "conductivity" loses its old significance.

To reduce Centigrade Degrees to Fahrenheit. — Double the number of Centigrade degrees, subtract one-teuth of the amount, and add thirty-two to the remainder. For temperatures below 0 Centigrade, subtract thirty-two.

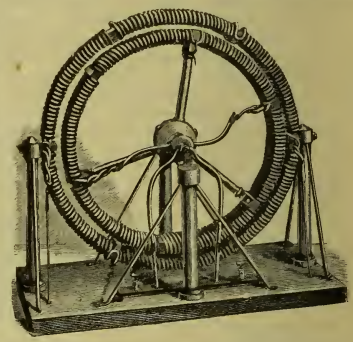
On the Presence of Oxygen in Silver. — Van de Plaats has critically reviewed the work of Dumas, from which that chemist was led to conclude that silver always retains oxygen after fusion in presence of that element. The silver was heated to ebullition in an unglazed crucible, by the application of an oxy-hydrogen blowpipe flame to its surface. The almost boiling metal was then poured into cold water in a tall, cylindrical vessel, at the bottom of which was placed a silver crucible. About ten grams of this granulated silver was then heated to the softening point of Bohemian glass, successively in currents of air, hydrogen, and carbon-monoxide, and subsequently in a vacuum, the gases in each case being carefully purified. The experiments showed that silver purified according to the method of Stas does not sensibly decrease in weight when heated in a vacuum to 600° C. for about three hours, and the weight of the silver did not vary by heating in the gases named.

Practical Chemistry and the Arts.

AN EARLY FORM OF ELECTRIC MOTOR.

When Faraday, in 1831, discovered the inductive action of the electric current, he probably had no conception of the immense importance and far-reaching results of his discovery. All our modern inventions of dynamo-machines, electric-lighting apparatus, electric motors, and even telegraphs and telephones, depend upon this simple principle of induction; and it was not long after Faraday announced his discovery, that attempts were made to make a practical use of the principle involved. In 1832 Pixey and Clark constructed the first forms of dynamo-machines; but they were only of theoretical interest, and could not produce currents of electricity of sufficient strength for any industrial use.

The primitive form of all the different machines for transforming mechanical energy into electricity, consisted of a horseshoe mag-



net, between the poles of which soft iron armatures, wound with a coil of insulated wire, revolved. Every time the armature passed before a pole of the magnet, a current of electricity was induced in the wire surrounding it; and the quicker the armatures were revolved, the more powerful the current. Under the most favorable circumstances, however, the current produced from a single magnet was very weak, and the number of magnets and armatures was increased with the view of developing a stronger current. Even then the results were not satisfactory, and about 1867 the principle of *self-excitation* was applied to the dynamo electric machine. Briefly stated, this was simply the substitution of electro-magnets for the permanent magnets hitherto used. These, being much more powerful than the permanent ones, induce a correspondingly powerful current in the revolving coils; and a part of this same current is used to excite the inducing electro-magnet. Thus, when the armature first begins to revolve, the slight residual magnetism in the electro-magnet induces a weak current in the coils: a part of this, passing through the wires coiled around the electro-magnet, increases its power, and enables it to induce a still more powerful current in the revolving coils; and this mutual reaction between the electro-magnet and coils continues

until the maximum current is produced that can be obtained from the mechanical force exerted to put the coils in motion.

In 1869 the first practical dynamo electric machine was invented by Gramme, who combined the revolving armatures together in a continuous ring, and made many improvements in the methods of collecting the current, and causing it to flow continuously through the circuit, instead of changing its direction with every revolution of the armature.

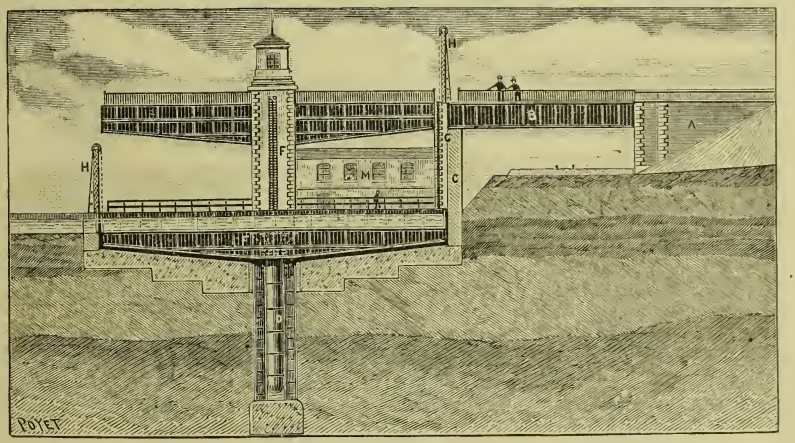
All the recent forms of dynamo-machines are founded upon the Gramme system, but it would seem that the ring form of armature was invented over a quarter of a century before. There was exhibited in Paris, in 1881, a machine constructed in 1843 by a Dutchman named Elias. Although this was intended as an electric motor, to transform electric energy into mechanical force, instead of the reverse process, as in the Gramme machine, yet the principle is the same. It consists of two concentric rings, the outer one fixed, and the inner one turning on its axis; each ring being composed of six electro-magnets. When an electric current is sent through the coils, magnetism of opposite polarity is induced in the electro-magnets of the two rings, and they are attracted towards each other. This causes the inner ring to revolve, until the two sets of magnets are opposite, when, by an automatic commutator, the direction of the current is reversed, and the polarity of the magnets becomes the same. This causes a mutual repulsion; and the inner ring is driven forward one-twelfth of a revolution, until its magnets are halfway between those of the fixed ring, when the current is once more reversed, and the process repeated, thus causing a continuous revolution.

Unlike the Gramme and nearly all other dynamo-machines, the Elias motor is not *reversible*. In the Gramme dynamo, for instance, when the armature is revolved by mechanical power, a current of electricity is generated in the coils; and, conversely, if a current of electricity from some outside source is sent through the coils, the armature revolves, and the dynamo-machine is transformed into an electric motor. In many other ways the old machine of 1843 is inferior to the modern forms, but is interesting as showing the first suggestion of a principle which is at present one of the most important and valuable known to electrical and mechanical science.

A HYDRAULIC LIFT FOR CANAL-BOATS.

The Canal of Neuffossé, in the north of France, connects the ports of Calais, Dunkerque, and others, with the canal systems of France and Belgium, and supports a large and increasing traffic. Unfortunately, at one point in its course there is a sudden change of level of nearly fifty feet, which has heretofore been overcome by a series of five locks. To avoid the delay which their passage occasions to the boats, an immense hydraulic lift is being constructed, similar to one already in use in England, by which the boats can be transferred in a few minutes from one level of the canal to the other. The works were commenced in 1883, but are not yet completed.

Briefly described, the lift consists of two immense iron tanks, supported by pistons, *D*, which move in a steel cylinder filled with water. The tanks are placed side by side, and the two cylinders communicate with each other. A valve in the connecting pipe enables the communication to be cut off when necessary. It will thus be seen, that when the tanks are filled with equal weights of water, and the two cylinders connected together, they will just balance each other, and no movement will take place; but by adding an additional weight of water — in practice about twenty tons — to the tank at the upper level, it will fall, at the same time raising the opposite tank.



The operation of the lift is as follows: One of the tanks stands at the upper level of the canal, and the other at the lower. Both are filled with water to the same level, and thus balance each other when the valve connecting their respective cylinders is opened. The gates connecting them with the canal are then opened, the canal-boats floated in, and the gates closed. The addition of the boats makes no difference in the weight of the tanks; for, according to a well-known principle of hydraulics, they displace a weight of water just equal to their own weight, which is allowed to flow away. An additional quantity of water is then pumped into the tank standing at the upper level; and, as soon as the additional weight is sufficient to overcome the friction, it descends, at the same time forcing up the lower one. Thus a single operation is sufficient to transfer two boats at once in a very few minutes, saving nearly two hours of time, which was formerly occupied in passing through the locks.

The accompanying engraving, from *La Nature*, shows the plan of the structure with the tanks at the different levels. To support the immense weights which it will carry, it has been constructed in the most solid and thorough manner. Five millions of bricks and over twenty-five thousand cubic feet of stone have been used on the masonry, and more than eighty-eight thousand rivets were required in the iron-work. When finally completed, it will be a notable piece of engineering work, as well as an ingenious practical application of the principles of hydraulics.

ANILINE DYES IN THE EAST.

It is reported in Indian journals that the Shah of Persia has recently decreed that any carpet-weaver who is found using aniline dyes shall be punished by having his hands nailed up over his door. This decree points to an evident determination of the Persian ruler to save one of the staple industries of his dominions from ruin through the demand for "cheap and nasty" goods; and, if carried into effect, it will no doubt put a stop to the importation of aniline dyes into Persia. In British India, also, many voices are raised against the growing employment of aniline dyes as coloring materials; and the Indian government is urged to take measures which, if less drastic than those resolved upon by the Shah, shall tend in a similar direction. It is claimed that a heavy import duty on aniline goods would yield a good revenue, and at the same time encourage the use of the beautiful original indigenous dyes which continue to lose ground. It is stated that the principal authorities on Indian affairs at the recent exhibition were unanimous in their condemnation of aniline dyes, as likely to lead to the ruination of Indian fabrics. But if that be the case, it is strange that all the while, notwithstanding their indignation, they took no notice whatever of the fact that the Benares brocade-weaver employed in the exhibition used exclusively silk steeped in aniline colors. The Poona silk-manufacturers also, it is said, use none but the aniline dyes now, although in some departments of the Indian Government the employment of these dyes has recently been discouraged. In the presidency of Bombay, for instance, the dyes are no longer allowed to be used in the prisons, where carpets and similar articles are manufactured on a large scale. — *Chemist and Druggist.*

HOW ARAGO MEASURED THE POWER OF STEAM.

THE experiments which were entered upon for the purpose of measuring the force of the vapor of water were very important and very dangerous: important, because the safe working of steam-engines was dependent upon correct measurements of the force, and because all the properties of heat had to be passed in review; and dangerous, because they "imposed the task of confronting the unknown caprices of a formidable force. There were but two men to accept it and conduct it to success: Arago, who never shrank from a duty; and Dulong, already maimed by an explosion, whose previous studies had admirably prepared him for the new work." A rude manometer was extemporized, and a boiler, far less stanch than the steam-boilers of to-day, was set up, in which water was heated till the pressure was twenty-seven atmospheres [405 pounds]. "They could not go farther. At this extreme point, it leaked at all the joints, and the steam escaped through the fissures with a hissing that was of bad omen. But the observers, though aware of the danger, silent and resigned, finished without accident the measurements which they had begun." Telling M. Jamin the story, which was written out as above from his dictation, Arago said: "Only one being of our company preserved his serenity, and slept quietly: it was Dulong's dog; they called him Omicron." — *Popular Science Monthly for December.*

INDUSTRIAL MEMORANDA.

A HOT MIXTURE of one-third paraffine and two-thirds gutta-percha, forced into the pores of wood, is winning favor as a means of preventing decay.

WASTE OF STEAM IN WHISTLING.—A well-posted railway man says that the obligatory tooting of a locomotive on the New York, New Haven, and Hartford Railroad, in an ordinary day's run, involves a waste of steam requiring the consumption of two hundred and eighty pounds of coal to renew. He estimates the whistling expenses of that particular railway at fifteen thousand dollars per year. There is a similar waste in the blowing of the whistles of stationary and steamboat engines. It is a matter worth the serious study of practical railroad men, whether they cannot devise a cheaper noise with which to give notice of the approach of trains to stations and grade crossings.

LETTERS SENT IN CANNON-BALLS. — At the siege of Steenwick, in 1581, leaden cannon-balls were used, each weighing about five pounds. These were hollowed out on one side; and a letter or other missive was placed in the cavity, which was afterwards closed with a lead capsule. To the other side of the ball was attached a piece of tarred rope. When one of these balls was fired from a cannon into the town, the blazing rope, as a messenger from the camp of their allies, informed the inhabitants that the ball contained letters; and it was then opened. Similar projectiles were used to convey messages during the siege of Turin, A.D. 1640.

A SURE METHOD OF CUTTING GLASS TUBES. — Ernest Beckmann states that glass tubes of any thickness and diameter, as well as funnels, bell-jars, etc., may be safely cut by making a file-mark, and then building up rings of wet filter-paper, one to two millimeters high, and two to four millimeters wide, on each side of the mark, at a distance of one to two millimeters. The intervening space is then heated in a Bunsen-burner flame, or, better, by the pointed flame of a blast-lamp, while the tube is rotated on its axis. The tube then separates at once in the line between the walls of filter-paper. The paper must be saturated with water, must be evenly laid on, so that it builds up straight walls, and the thickness to which it is wrapped will depend upon the diameter and thickness of the tube.

A POCKET HELIOGRAPH. — A pocket heliograph or optic signaller has been brought out by Dr. E. Gavoy, and introduced into the French military telegraph staff by the Minister of War. It consists of two copper tubes of five centimeters in diameter, sliding one within the other. The upper tube carries a plane mirror, inclined at an angle, and throwing off the light of a lamp, or the sun reflected up to it from an adjustable mirror in the lower tube. The light thus thrown off passes along a short tube at right angles to the upper part of the main tube, and, in doing so, traverses two lenses, one plano-convex, the other double convex. Between these two lenses is an adjustable shutter, by which the rays are occulted so as to make the signals. An oil-lamp, with reflector to throw its rays on the lower mirror, is added to the apparatus in such a way that it shuts up within the lower tube under the lower mirror. A lunette, to indicate the path of the rays through the air to the distant observers, is also fitted to the top of the apparatus. According to trials recently made in the park of Versailles, the apparatus worked satisfactorily over distances of from a thousand to twelve hundred meters.

A NEW PROCESS OF ROUND FORGINGS. — Mr. George H. Simonds of Fitchburg, Mass., has invented a machine for the purpose of forging iron or steel in any form which can be turned. This involves an entirely new method of working iron. Instead of being hammered or rolled to the desired form, the mass of red-hot metal is placed in a groove in two plates which are moved in reverse directions; the grooves are in primitive form at the places where the iron first enters between the plates, and along its course these grooves become more closely in conformity to the shape which is given to the finished piece, which is twisted into shape. The process is applied with success to the manufacture of conical shot forged out of steel; the British Government having given an order for five hundred thousand shot, which are being made by the English representative. This process is applied to the manufacture of any small iron or steel pieces of turned form.

A NEW ELECTROTYPING SOLUTION. — Dr. Gore, F.R.S., the well-known authority on electro-deposition, has discovered that an aqueous solution of asparagine is a good medium for electrolytic baths. The solution he used was not quite saturated, and consisted of about .88 gram of crystals of asparagine dissolved in 18 cubic centimeters of distilled water. It was feebly acid to the test-paper, and was employed at a temperature of about 70° C. Some of the liquid was more or less saturated with different metallic oxides, and the resulting baths electrolyzed by currents from one to six cells of zinc and platinum in dilute sulphuric acid. Good deposits of cadmium were obtained from .23 gram of hydrated oxide of cadmium dissolved in 20 cubic centimeters of the solution, using an anode of cadmium and a cathode of copper. Zinc was deposited from .28 gram of zinc oxide in 23 cubic centimeters of solution. Magnesium in a film was also deposited from calcined magnesia with magnesium and copper electrodes, copper was obtained from cupric oxide with copper and platinum electrodes, mercury from red mercurous oxide with platinum electrodes, and silver from oxide of silver with a silver anode and platinum cathode. In the latter case the deposit was good, the bath consisting of .33 gram of silver oxide in 20 cubic centimeters of asparagine solution.

Home, Farm, and Garden.

THE HISTORY OF CULTIVATED PLANTS.

MAN, as far back as we can trace the history of the race, has always cultivated some of the plants which are raised upon our farms to-day. In the earliest times life was doubtless supported by the spoils of hunting and fishing, and by such wild fruits as were suited to the purpose; but cultivation of some sort must have been resorted to very early, for in the oldest monuments of our progenitors — ancient tombs, cave and lake dwellings, and other prehistoric remains — we find specimens of grain, especially wheat.

The time and the manner of the first cultivation of many plants cannot be traced, but the history of others is comparatively recent. Since we know that so many cultivated forms are derived from wild originals, it is safe to decide that all are, though the primeval stock may now be extinct or unrecognizable. Before the theory of evolution had come to be generally accepted, it was believed that the grains had been specially created for the use of mankind; but now we assume that man developed them for himself by "artificial selection," merely taking advantage of natural tendencies. In many cases the wild species still exist, side by side with the cultivated forms; and the work of development is continually going on before our eyes.

The originals of the majority of our farm-plants are to be sought in Oriental lands, since the home of the Aryan races, the progenitors of modern European peoples, was in the uplands of Central Asia. And here we may remark, that comparative philology is of great service to us in tracing the history of a plant. If we find in any ancient language — the Sanserit, for instance — a native name for any plant, it is good evidence that the plant originated in the regions where that language was spoken. If, on the other hand, we do not find a name for the plant until we come to more recent languages, like the Latin and Greek, we may infer that it began to be cultivated in Italy or Greece, not in ancient India. The finding of seeds in old tombs enables us to compare them with the more developed forms of our day, and also, with the wild forms from which we suppose them to be derived. In some cases — the wild parsnip, for example — the experiment has actually been tried of developing the original plant into something similar to the modern cultivated variety. A few years of selection and culture have sufficed to show that vegetable products suitable for man's use can thus be obtained; and this tends to confirm the theory, that all our farm-plants have been thus "evolved" from wild prototypes.

It has been plausibly suggested, that some plants attracted the attention of ancient cultivators by certain obvious points which suggested their possible utility, such as a fleshy root or a large edible seed. In modern times a wild plant is occasionally thus recognized as likely to be useful for food or medicine, or

in the arts; and its value is tested by cultivation. On the other hand, certain plants that have been cultivated for centuries may cease to be of agricultural importance, because chemical science teaches us to make synthetically the organic compound to which they owed their value. The influence of the artificial production of alizarine upon the cultivation of madder is an illustration in point.

It has been asserted by good authorities that only about two hundred and fifty plants, aside from floral varieties used merely for ornament, are cultivated, out of some hundred and twenty thousand species known to botanists. This seems to be a very small proportion, but it is larger than that of domesticated to wild species of animals.

Of these two hundred and fifty plants, less than a score represent the principal crops of the farm. In the case of some of these, as the grasses, there is little if any distinction between wild and cultivated forms. The former, which grow wild almost everywhere, only need the stimulus of manuring and cultivation to become undistinguishable from the latter. Their cultivation in Europe dates back only to Roman times.

In the case of wheat, on the other hand, we have an example of a plant that has been cultivated from a period so remote, that we cannot positively recognize the original from which it sprang. Some have believed that they discovered the wild plant in India, and others think they detect it in a grass found upon the shores of the Mediterranean. According to a French botanist, twelve years of careful selection are sufficient to produce a fair sample of wheat from this wild grass.

Barley has also been cultivated from prehistoric times, but its origin can be clearly traced to wild forms that are still common in the vicinity of the Caspian and the Caucasus. Oats have been raised by man for only about two thousand years. The philological evidence goes to show that the plant belongs to Eastern Europe and Tartary. Oats, when left to themselves, are more persistent than most cultivated plants; but no truly wild variety has yet been found. The "wild oats" of Europe are said to grow only in cultivated land, and a few years of selection will develop them into a good variety. This indicates that they are derived from the cultivated plant, and not originally wild.

A CENTRIFUGAL MILK-TESTER.

This apparatus has recently been invented in England, and is used to determine the quality or richness of milk, by separating the cream by centrifugal force, and indicating the percentage upon a scale.

It consists of a circular plate of metal in the shape of an inverted saucer, which is connected with gear-wheels, so that it can be rotated with great velocity. One or more little brass cases (*F*, Fig. 2) are suspended from this plate by trunnions, which allow it to move freely in a vertical plane. Inside the case is placed a glass test-bottle, *G*, which has a graduated scale marked on its neck.

To test a sample of milk, the test-bottle is filled up to the zero mark on the scale. It is then placed in the brass case, which is attached to the revolving disk. The apparatus thus arranged is shown in section in Fig. 2. On setting the machinery in motion, the cases and

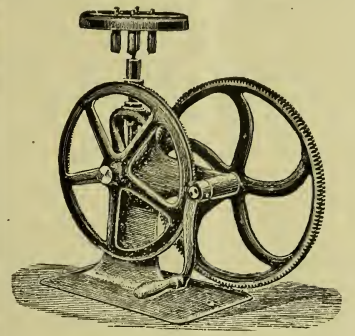


Fig. 1.

enclosed bottles immediately fly up into the position shown by the dotted lines. The action of the centrifugal force separates the heavier portions of the milk from the cream; the former being driven to the end or bottom of the bottle, leaving the cream in the narrow neck. A few seconds suffice to complete the separation; when the test-bottle is removed, and the percentage of cream read off from the

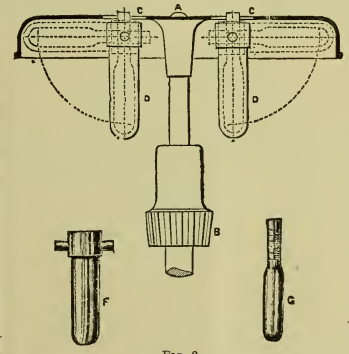


Fig. 2.

graduated scale. Four samples can be tested at once, and the temperature of the milk is immaterial, although from 60° to 70° is best.

An instrument of this sort would be especially useful to creameries or cheese-factories, where large quantities of milk from different sources are daily received. For many purposes the determination of the percentage of cream is quite as useful as a complete chemical analysis, and the quickness and ease with which it can be performed by inexperienced persons is a strong recommendation for this pattern of "milk-tester."

BAKING-POWDERS.

The use of baking-powders as a substitute for yeast in bread-baking and other culinary processes, is becoming more and more prevalent, and in some sections of the country they have almost entirely supplanted the old-fashioned methods. They all consist of bicarbonate of soda mixed with some acid salt, which, when moistened, unites with the soda, setting free the carbonic-acid gas, which permeates the dough, and by its expansion causes it to puff up and become light. The salts resulting from the combination remain in the loaf of bread or cake, causing it to be less pleasant to the taste than when yeast is used. In the latter case the carbonic-acid gas is derived from the decomposition of the starch of the flour, and no inorganic salts are formed.

The salts most commonly used in baking-powders to decompose the bicarbonate of soda are acid tartrate of potash or cream of tartar, acid phosphates, and alum. Carbonate of ammonia is sometimes added, which is readily volatile at the temperature of the baking-oven, and furnishes an additional quantity of gas.

While we consider all baking-powders to be very poor substitutes for yeast, and would never recommend their use, yet, in view of the many erroneous statements so widely circulated in the advertisements of rival manufacturers, the following may serve as a guide to housekeepers in making their selection.

The cream of tartar baking-powders are the most extensively used; the presence of a small amount of tartrate of lime is of no importance, and is usually an accidental impurity.

Carbonate of ammonia in small quantities is not especially objectionable; but, in view of the possibility of its incomplete decomposition during baking, its use cannot be very highly recommended. It is not made from "disgusting sources," and is perfectly purified in the process of manufacture.

The phosphatic baking-powders are equal to those made from cream of tartar. It is claimed that the phosphates which they introduce into the bread take the place of those lost in the bolting of the flour. While we think this is only partially true, we consider them as good and wholesome as any in the market.

Alum baking-powders should always be avoided. Alum is a powerful astringent, and is not fit to be taken into the stomach. In addition to its directly injurious properties, it renders the bread more indigestible.

The cheaper grades of powder sold in bulk usually contain alum or other objectionable ingredients. It is best to purchase only those powders put up in separate packages by manufacturers of established reputation, as in this way only can one be sure of obtaining a good and pure article.

THE ENGLISH SPARROW.

From the complaint of a correspondent of the *Agricultural Gazette* (London), given below, it would seem that this much-discussed bird has as bad a reputation at home as he has among certain farmers in this country. He writes: —

"You have often called the attention of readers to the general alarming increase of sparrows. The cause of this increase has received your attention. Many of your correspondents have wailed over its effects; yet, so far, I think no prescription of

drastic measures has been forthcoming to stay the scourge. We have in this neighborhood 'clouds' of sparrows. They follow the manure-cart, the drill, and are never absent in any distribution of corn-food. They devastate in harvest, and, locust-like, devour all the young newly grown green of winter. Beyond this, they disbud the fruit so effectually on extensive plantations, that a remunerative crop becomes impossible. What is to be done to stay the plague — for I assure you it is this to us — is the most pressing question of to-day. The usual methods for lessening their numbers have been tried, and have failed. Nests have been systematically taken in the breeding season, gun and net have been unceasingly employed; and, despite last winter's severe weather, they are here — busy, destructive — in vastly increased numbers this year. The direct loss sustained by their ravages, I am assured, is incalculable; and I am not at all sure the indirect is not greater. Why is it that the past few years have been so notable for insect ravage? Why is it we have a lessening number of purely insectivorous birds? Am I wrong in my guessing? Sparrows! sparrows!! We should be very glad if for us and for others some real remedy could be found."

SELECTED RECIPES.

Tomato Omelet. — Peel four ripe tomatoes, and cut or chop them into little dice. Make a heaped tablespoonful of flour into a smooth paste with a little cold milk; add a little salt and pepper, six well-beaten eggs, and the tomatoes. Beat the mixture thoroughly, and fry the omelet in the usual way. It may be folded over, if liked, but must not be turned. It will require from six to eight minutes to cook properly.

Ginger-Bread. — Four ounces sugar, one pint molasses, three eggs, one teaspoonful ground allspice, one-half pound boiled cerealine, four ounces butter, one-half teaspoonful lemon extract, one teaspoonful ground cloves, one-half teaspoonful ginger, one ounce baking soda; put into a pint of milk, stir it up, and mix to a smooth cream, then add one and a half pounds flour; put into a papered square pan, and bake about half an hour in a hot oven. When done, ice with lemon-water icing.

Potato Soup. — Put into a stewpan three pints of white stock; take six large mealy potatoes, boil them until they are nearly done, cut them in slices until they are sufficiently tender to pulp through a sieve, with an onion boiled soft enough for the same purpose. Thicken with flour and butter, and season with white pepper, cayenne, and salt. To enhance the flavor, cream should be added, half a teacupful, previous to serving, but must not be permitted to boil after adding.

Harlem Buns. — Take three-fourths of a pint of cerealine, one-half pint of milk, four eggs, one-third of a cupful of butter, one and a half teaspoonfuls of baking-powder, one and a half pints of flour, one-half cupful of candied citron-peel cut in small, thin slices, one-third of a cupful of sugar. Rub the butter and sugar to a smooth, light cream, then add the eggs (two at a time), beating five minutes between each addition of eggs; add the flour sifted with the baking-powder, then add the citron-peel, cerealine, and milk, and mix into a moderately firm batter; lay well-greased muffin-rings in a greased baking-tin, and put a large spoonful of the batter into each; sift sugar over the top of them, and bake fifteen minutes in a hot oven.

Rice Snowballs. — Boil one pint rice until soft in two quarts water, with a teaspoonful salt; put it in small cups, and when perfectly cold place in a dish; make a boiled custard of the yolks of three eggs, one pint sweet milk, and one teaspoonful corn-starch; flavor with lemon; when cold pour it over the rice-balls half an hour before serving. This is an excellent and very simple dessert.

Oyster Fritters. — Drain off liquor, boil, skim, and to a cupful add a cup of milk, two or three eggs, salt and pepper, and flour enough to make a rather thick batter. Have hot lard or beef drippings ready in a kettle, drop the batter into it with a large spoon, taking up one oyster for each spoonful; the oyster must be large and plump.

Entrée of Oysters. — Delicious with game of any kind. Scald one dozen fine large oysters in their own liquor. Skim them out; mix a teaspoonful of flour with half a pint of cream and a well-beaten egg. Stir in the oyster broth; when it thickens up, squeeze in the juice of half a lemon, and pour it over the oysters, already placed in a hot dish.

Salmon Potatoes. — Select six medium-sized potatoes, cut them in two crosswise, scrape out a little of the inside of each, and fill the space with nicely seasoned salmon; press the potatoes together, tie them with twine, and bake; when done remove the string without spoiling the appearance of the potato, and serve. If ladies are at table, re-tie the potato with dainty silk ribbons, and serve them on napkins.

Drop-Cake. — Take one-half pint of cerealine, one cup of butter, four eggs, one cupful of currants washed and picked, and one-half cupful of milk, one pint flour, three-fourths cupful milk, one teaspoonful of baking-powder, one teaspoonful each of extracts of orange and cinnamon; rub the butter and sugar to a light cream; add the eggs, and beat for ten minutes; add the flour and baking-powder sifted together; add the milk, cerealine, currants, and extracts; mix the whole into a rather firm batter, and drop with a spoon on a greased baking-tin. Bake in a hot oven for about ten minutes.

American Analyst.

GLEANINGS.

Stock and Graft. — Some observations have been made by Strasburger recently on the reciprocal influence of stock and graft, and on the limits within which plants that are specifically distinct will permit of grafting or budding. He succeeded in grafting *Datura Stramonium* on *Solanum tuberosum*. The resulting plant produced good-sized tubers, which contained a small quantity of atropine. But, what is still more remarkable, he successfully grafted *Schizanthus Grahami* on *Solanum*, these plants belonging to distinct natural orders, the former to the *Scrophulariaceæ*, and the latter to the *Solanaceæ*. It is the first instance on record where a union of this kind has been accomplished between plants so remote in their relationship. A novelty in horticulture in California is the successful grafting of Italian chestnuts on the ordinary black oak. It has been practised with the best results in a number of instances in the Napa valley.

To Remove Varnish without injuring paint, brush on spirits of ammonia or hartshorn, which softens the oil, allowing of its being rubbed off easily.

"High Life."— The Rockies themselves rise at various places to a height exceeding 11,000 feet. Of the twenty most famous passes, only seven are below 10,000 feet, while five are upward of 12,000 feet, and one, the Argentine, is 13,000 feet. Of the seventy-three important towns in Colorado, only twelve are below 5,000 feet, ten are over 10,000 feet, and one is 14,000 feet.

Honey. — Charles S. Commings, Ph.G., states that honey gathered from white clover, basswood, and raspberry is of a light color, and has a delicious flavor; but the bees will not gather it from white clover as long as it can be gotten from other plants. Considerable honey is also found in the blossoms of fruit-trees, of the maple, locust, and other plants. Buckwheat honey is considered inferior, it being darker in color and less agreeable in flavor than that procured from many other plants.

Protection for Trees. — When the ground is thoroughly frozen, and all the better if covered with snow, it is a good plan to draw manure, and spread over the snow and frozen ground under the trees. A covering of straw is better than nothing, as the object is protection from deeper freezing of the ground. With this covering, the snow under the trees is kept from blowing away or thawing until late in the spring. By this means the early-blooming fruit-buds will be kept back until danger of spring frosts has passed, and it is also some protection to peach-trees against winter-killing by severe cold. By this method peaches may be grown in those localities where they thrived when the country was new, and the ground was everywhere covered all winter with snow.

Hotbeds. — It is noticeable that in hotbeds lettuce is far less subject to "burn" than in greenhouses. This is doubtless in consequence of the greater freedom with which air enters the bed close to the plants, and to the more even temperature of the bed at night, when they are covered with mats. The usual structure of greenhouses makes covering with mats impracticable.

Weather-Signals. — The new government code requires the use of four signal-flags, the kind and signification of which are as follows: A square *white* flag will signify clear or fair weather. A square *blue* flag will signify rain or snow. A *triangular black* flag will be used for temperature indications. When placed *above* the square flag, it will signify higher temperature, or warmer weather; when placed *below* the square flag, it will signify lower temperature, or colder weather. A square white flag with a *black square* in the centre will signify a cold wave. This is the present cold-wave signal, and is retained.

When these signals are suspended from a horizontal pole or rope, a small white streamer will be used to indicate the end from which the flags are to be read.

Potatoes. — According to Professor P. Wagner, steamed potatoes are far more nutritive than boiled ones. With the latter, not only is more water taken up, but also nutritious salts are extracted by the surrounding water. The author publishes analyses in support of his opinion.

Evolution of Fruits. — Dr. Maximowicz, a Russian botanist, remarks, that in Western Asia and Europe, where the peach is prized as a fruit, it is this which has developed so many and great variations; while in China and Japan, where ripe peaches are less esteemed (being thought unwholesome), and the tree enters into ornamental cultivation, it is the flowers which are greatly varied.

Oil-Meal for Cattle. — Fattening stock on roots, mainly turnips, is common in England; but even these roots are supplemented by oil-meal, and of late years by corn. Our colder winters make roots unsuitable as a staple food; and, while corn continues as cheap as it has been, it will hold the preference it has long enjoyed as a food for fattening stock. The tax on oleomargarine may have some effect in saving cotton-seed for feeding stock, instead of getting the oil out of it to make into imitation butter.

Dangerous Ware. — An order has been issued in Lower Austria forbidding manufacturers and tradesmen to sell nickel-plated cooking-vessels. It is stated that vinegar and other acid substances dissolve nickel; and that this, in portions of one-seventh of a grain, causes vomiting, and is even more poisonous than copper.

The Popular Science News.

BOSTON, FEB. 1, 1887.

JAMES R. NICHOLS, M.D.
WILLIAM J. ROLFE, A.M. } . . . . . *Editors.*
AUSTIN P. NICHOLS, S.B.

On the morning of Jan. 4 the through Western mail was destroyed by a railroad accident at Springfield, Mass. Western subscribers who sent remittances one or two days previous to that date, should write to the publishers of the SCIENCE NEWS *(enclosing a postal-card) for information regarding the receipt of their letters.*

The paper edition of Dr. Nichols's book, "Whence, What, Where?" (price 50 cents), will be given FREE, *as a premium to every new subscriber. To avoid misunderstanding, subscribers entitled to the premium copy will please state in their letter that they desire it; otherwise, there may be delay in sending it.*

THE American Psychical Society, poor thing, is in a bad way. It needs nourishment, warmth, and interested attention, to prevent it from dying of a complication of infantile maladies which arise from bad nursing. The chief nurse, Professor Newcomb (president), gave the bantling an *ice-bath* in January (his presidential address), and this practically put the thing in its coffin. We have never had high anticipations of the usefulness or continued existence of this organization. It is a queer proceeding to throw a new-born baby on a rubbish-heap, and leave it there, while its parents walk around *on stilts* to look at it. The British society is glowing with warmth compared with the state of its American cousin. It is clear that the psychical knowledge which the society desires to obtain will never come to it under its present management; indeed, we are inclined to think no society under any management can obtain satisfactory knowledge of the kind which is sought. It must be obtained in *private*, under conditions far different from any which can be secured in organizations, where men act together, with diverse views, opinions, and prejudices.

THE problem of transmitting telegraphic messages without the use of wires is one worthy of attention, although but little progress has yet been made in that direction. Some time ago Professor Dolbear of Tufts College exhibited a telephone through which articulate words could be distinctly heard, even when it was not connected with the line-wire. This phenomenon was due to the inductive action of the current transmitting the words; and Professor Dolbear has recently published the details of a method by which he can transmit signals for a distance of half a mile at least, without the use of any connecting wire. It depends upon the same principle of induction, — the varying electrical condition of the apparatus at the transmitting station, inducing a similar condition at the receiving end. Although the invention is as yet only in the experimental stage, it may, if found of practical application, prove to be of equal importance with that of the telegraph itself.

THE distinguished English naturalist Dr. Alfred R. Wallace who is making a brief visit to this country, has recently finished a course of lectures before the Lowell Institute in this city, which have been of the greatest interest. Since the death of Darwin, Dr. Wallace has been the chief expounder and supporter of the evolutionary theory, which he thought out independently of Darwin, and before the publication of the *Origin of Species*. He differs from Darwin, however, in holding that the development of the human mind cannot be accounted for by the ordinary processes of evolution, but must be considered as something apart from the physical nature, and subject to different laws. That such views are held by so eminent a scientist, will doubtless be very gratifying to those who are unable to harmonize the Darwinian theory with their religious belief.

"THE Limit of Speed in Ocean-Travel" has been very widely discussed of late in engineering journals; and the general conclusions arrived at seem to favor the belief that even the six-day passages now made across the Atlantic Ocean may be considerably shortened, the principal obstacle being that of the expense of maintaining such high speeds. Although an increase of speed may be very desirable, yet we think the majority of travellers would prefer to see some attempt made to improve the accommodations and food provided for passengers on the most famous boats even, of the Atlantic ferry. The horrors of seasickness are usually experienced during the first four or five days of the voyage only; and, even if the passage was made in that time, the amount of suffering would not be diminished. But clean, comfortable rooms, a sufficiency of light and pure air, palatable food, good cooking, and civil treatment from officers, all of which are at present sadly lacking on most of the transatlantic steamers, would render the journey much more endurable, and would be vastly less expensive than attempts to reduce the time by a few hours. A large business awaits the steamship company which first furnishes its patrons with the necessities and comforts enumerated above.

THE COLD.

ONE of the most remarkable peculiarities of the human constitution is its endurance of extremes of heat and cold. From the arctic circle to the equator we find man living under the most varied climatic conditions. With the exception of his inseparable companion, the dog, no other animal can exist in all the varied climates where the human race lives and flourishes.

Extremes of heat and cold are simply relative. The Englishman looks upon the zero weather of the United States as a temperature of arctic severity, and we remember once seeing in Holland a thermometer on which 80° F. was marked as being the exceptionally high temperature attained on a certain day some years previously. A native of equatorial Africa or Southern Asia, on the contrary, would consider the debilitating heat of North-American summers as pleasant and bracing weather. Under all circumstances the heat of the healthy human body remains the same, and the fires of the natural furnace in which the food we eat is oxidized and consumed, are always regulated by the mysterious vital force to within about a degree of 99° F. under all conditions of outside temperature.

The temperature of the interior of continents in winter is always lower than near the sea-coast, where the equalizing effect of the ocean is felt. Owing to the greater specific heat of water over air, and other causes, the temperature of the ocean varies but little at different seasons, and thus warms the air in winter, and cools it in summer. The cold waves which sweep over the Northern States at irregular intervals during the year are caused by the cold air from the central and northern part of the continent rushing across the country towards the ocean, — impelled, probably, by some irregularity of barometric pressure not very well understood. These cold northwest winds are indeed a peculiar feature of our climate. The exact point from which they start is unknown: and a theory has even been advanced, that the cold and dry air which they bring has its source in the upper regions of the atmosphere. With the increased opportunities for observation as the north-western country becomes more thickly settled, more light will doubtless be shed upon the problem.

The most extreme cold in North America has been observed in the interior of Canada and the section known as the British Possessions. In Pembroke the mercury has been known to fall as low as — 43°, and at Fort Reliance a temperature of — 69° has been observed.

Jakutsk, in the interior of Siberia, has heretofore been considered the coldest inhabited spot on the globe. The mean temperature of the year is about 32°, and the January temperature has been known to fall to — 49°. But Jakutsk is only six degrees of latitude farther north than the city of Edinburgh, which has a milder climate than that of Boston. The insular position of the Scottish city, and the influence of the Gulf Stream, accounts for this remarkable difference. The village of Werkŏjansk, in latitude 67° north, has been found to be even colder than Jakutsk, a temperature of — 67° having been indicated.

But lower temperatures than these, even, have been observed by exploring parties. At Fort Ray, on the banks of the Great Slave Lake, a temperature of — 76° has been registered; and the unfortunate Greely expedition experienced, at Discovery Bay, a temperature of — 66°.

Probably the lowest temperature ever observed was that reported on an Arctic expedition, under Lieut. Schwatka, in the winter of

1879–80, when it was claimed that the thermometer indicated ninety-five degrees below zero. The correctness of this most extraordinary temperature has been questioned by another member of the party, who states that the lowest point reached was but — 70°.

It must be remembered that the readings of thermometers at these extreme temperatures are more or less subject to error. As mercury congeals at — 40°, alcohol thermometers must be used for lower temperatures; and the rate of contraction of alcohol at very low temperatures may be different from that at higher ones. Nevertheless, the extreme cold of certain localities inhabited by man is an undoubted fact, and is a wonderful example of the ease with which he can adapt himself to his external environment.

[Specially reported for the *Science News* from the Observatory of the College of New Jersey.]

ASTRONOMICAL PHENOMENA FOR FEBRUARY, 1887.

MERCURY may be seen in the west, just after sunset, during the last day or two of the month. It reaches its greatest elongation east of the sun on March 4. Venus is an evening star, setting about an hour after the sun, and a little to the north. Mars is practically out of sight, and is approaching conjunction with the sun. Jupiter rises about midnight on Feb. 1, and at about 10 P.M. on Feb. 28. It is nearly stationary among the stars, moving slowly eastward until the 19th, when it begins to retrograde. It is about 15° east of Spica (*Alpha* Virginis). Saturn is on the meridian about 10 P.M. on Feb. 1, and at about 8.30 P.M. on Feb. 28. It is still near Castor and Pollux (*Alpha* and *Beta* Geminorum), to the south and west of those stars. On the morning of Feb. 6 it passes within 4′ of the third-magnitude star *Delta* Geminorum. Uranus rises about 10 P.M. on Feb. 1, and two hours earlier at the end of the month. It is sixth magnitude, and about 5° south-east of the third-magnitude star *Gamma* Virginis. Neptune is eighth magnitude, and about 6° south of the Pleiades.

There will be two eclipses during the month. The first is a partial eclipse of the moon, on the morning of Feb. 8; visible in the United States, the Pacific Ocean, and a part of Asia. The magnitude of the eclipse will be 0.436 (moon's diameter = 1). For the Eastern States it will end just about sunrise. The other eclipse is an annular eclipse of the sun, on Feb. 22, invisible in the United States. It will be annular on a line running through the Southern Pacific, from about seven hundred miles south of Tasmania, to the west coast of South America.

During the year 1886 eleven new asteroids were discovered; seven of them by Palisa, three by Peters, and one by Luther, making the number now known two hundred and sixty-four. Nearly all of those discovered of late years have been very faint, and out of the reach of small telescopes. Of those discovered last year, there were four of the eleventh magnitude, three of the twelfth, three of the thirteenth, and one of the fourteenth.

M.

PRINCETON, N.J., *Jan.* 3, 1887.

METEOROLOGY FOR DECEMBER, 1886, WITH PARTIAL REVIEW OF THE YEAR.

TEMPERATURE.

AVERAGE THERMOMETER.		Lowest.	Highest.	Range.
At 7 A.M.	20.90°	5°	38°	33°
At 2 P.M.	30.68°	11°	48°	37°
At 9 P.M.	24.09°	7°	48°	41°
Whole month	25.19°	5°	48°	43°
Second average	24.90°	5°	48°	43°
Last sixteen Decembers,	28.15°	21.29°, in 1876.	36.04°, in 1881.	14.75°
Second average	27.80°	20.98°	35.84°	14.86°
Year of 1886	47.11°	— 13°	90°	103°
Last sixteen years	47.54°	45.15°, in 1875.	49.57°, in 1878.	4.42°

The 30th was the coldest day of the month, with an average of 7⅔°; and the 24th was the warmest, averaging 44½°. The highest point reached was 48°, at 2 P.M. and also at 9 P.M. on the 24th. The entire month was nearly 3° colder than the average December for sixteen years, and was the coldest, with three exceptions (1872, 1876, and 1880), during this time. The most rapid rise of the mercury was 30° in seven hours, on the 10th; it fell all day on the 16th, and rose all day on the 5th, 7th, 18th, and 31st, and was most nearly stationary on the 13th and 30th.

PRESSURE.

The average barometer the past month was 29.999, with extremes of 29.35, on the 14th, and 30.45 on the 5th, — a range of 1.10 inches. The average for the last thirteen Decembers has been 29.948, with extremes of 29.804, in 1876, and 30 073, in 1879, — a range of .269. The sum of the daily variations was 7.67 inches, giving an average daily movement of .247 inch. This average for the last thirteen Decembers has been .259, with extremes of .190, in 1880, and .325, in 1885. The largest daily movements were .64 inch, on the 16th and 24th, and .62 on the 13th; and several others were quite large, nearly all in connection with stormy weather. The barometric changes were numerous and often great, with but few stationary observations.

SKY.

The face of the sky in 93 observations gave 42 fair, 12 cloudy, 20 overcast, 5 rainy, and 14 snowy, — a percentage of 45.2 fair. The average for the last sixteen Decembers has been 50.1 fair, with extremes of 41.9, in 1881, and 75.3, in 1877, — a range of 33.4. This shows that the past month has been nearly five per cent less fair than usual. The 8th and 28th were noted as especially fine. The evening of the 24th was warm and foggy, followed by a heavy rain in the night.

PRECIPITATION.

The amount of rainfall, including 24½ inches of melted snow, was 6.41 inches, well distributed through the month. The average precipitation for the last eighteen Decembers has been 3.84 inches, with extremes of .73, in 1875, and 7.89, in 1884, — a range of 7.16. Abundance of snow and rain, alternating with severe cold and a few warm days, made sleighing quite irregular and imperfect, and that for scarcely half the month.

WINDS.

The direction of the wind in 93 observations gave 16 N., 1 S., 0 E., 35 W., 9 N.E., 16 N.W., 1 S.E., 15 S.W., — an excess of 24 northerly and 56 westerly over the southerly and easterly; indicating the prevailing direction to have been W. 23° 12′ N. The westerly winds have uniformly prevailed over the easterly in December for seventeen years by an average of 15 71 observations, and the northerly over the southerly, with only two exceptions (1874 and 1881), by an average of 17.30; indicating the approximate general direction for December to be W. 17° 15′ N. The longitudinal extremes have been 35 W., in 1877, and 76 W., in 1882, — a range of 41 observations; and the latitudinal 33 N, in 1875, and 9 S., in 1874 and 1881, — a range of 42. The relative progressive distance travelled by the wind the past month was 60.93 units, and during the past seventeen Decembers 991.6 such units, — an average of 58.33; showing slightly less opposing winds than usual. The winds were quite severe on the 2d and 7th.

COMPARISONS OF TEMPERATURE, PRECIPITATION, AND FACE OF THE SKY.

MONTH.	TEMPERATURE. Average 16 Years.	TEMPERATURE. Average 1886.	TEMPERATURE. Difference.	PRECIPITATION. Average 18 Years.	PRECIPITATION. 1886.	PRECIPITATION. Difference.	PER CENT FAIR. Average 16 Years.	PER CENT FAIR. 1886.	PER CENT FAIR. Difference.
January	23.96°	22.74°	1.22°—	4.48	7.67	3.19+	53.9	50.5	3.4—
February	25.56°	24.04°	1.52°—	4.80	11.72	6.86+	58.2	51.2	7.0—
March	32.46°	32.95°	0.49°+	5.08	4.84	0.24—	50.6	44.1	6.5—
April	44.92°	49.07°	4.15°+	3.98	1.70	2.28—	50.6	52.2	1.6+
May	57.23°	57.23°	0.00°	2.96	2.90	0.06—	56.3	46.2	10.1—
June	66.83°	64.29°	2.54°—	2.83	0.91	1.92—	60.2	44.4°	15.8—
July	71.35°	70.76°	0.59°—	3.07	2.87	0.20—	63 8	68.8	5.0+
August	69.22°	68.23°	0.99°—	3.95	3.53	0.42—	63.8	73.1	9.3+
September	61.67°	61.38°	0.34°—	2.68	3.35	0.77+	60.2	52.2	8.0—
October	51.14°	49.40°	1.74°—	4.09	3.18	0.91—	58.3	60.2	1.9+
November	38.02°	40.12°	2.10°+	4.01	4.76	0.75+	54.6	54.4	0.2—
December	28.15°	25.19°	2.96°—	3.84	6.41	2.57+	50.1	45.2	4.9—
	47.54°	47.11°	0.43°—	45.73	53.84	8.11+	56.7	53.5	3.2—

The above table exhibits at a glance a comparison of the past year with the average of the last sixteen or eighteen years, in three respects, — temperature, precipitation, and fair sky, shown month by month, with the differences indicated by plus and minus. It will be noticed that the temperature of the last year was scarcely half a degree below the general average, the precipitation exceeded the average by 8.11 inches, and the fair sky fell below 3.2 per cent.

It may be interesting to note that the lowest point reached by the mercury in the last sixteen years was — 20°, Jan. 30, 1873; the highest point, 95°, July 4, 1872: making the range for the entire sixteen years 115°. The highest range in any one year was 113°, in 1873; the lowest 84°, in 1877. The coldest day during this period was Jan. 12, 1886, with an average of 6⅔° below zero. July 1, 1872, and July 18, 1878, were the warmest days, each with an average of 83⅓°. January, 1875, was the coldest month, and July, 1876, the warmest, in sixteen years; standing respectively at 17.50° and 74.36°. The average temperature for the sixteen years was 47.54°, with extremes of 45.15°, in 1875, and 49.57°, in 1878, — a range of 4.42°.

The average precipitation for eighteen years has

been 45.73 inches, with extremes of 32.26, in 1883, and 57.58, in 1878. The precipitation the last year was excessive during the winter-months, 25 80 inches; and yet seven months fell below their respective averages, and these chiefly the growing-months, when rains are most needed.

The average fair weather in sixteen years has been 56.7 per cent, equal to 207 days. March, April, and December are shown to be the least fair months in the year, and June to August the most fair. It is a surprise to find February comparing so favorably with October.

By a careful study of the tables many other items of interest may be discovered.

D. W.

Natick, Mass., *Jan.* 6, 1887.

THE OLD NIAGARA GORGE.

Niagara Falls and its neighborhood have, in large measure, attracted the attention, not only of tourists, but of geologists. So many strata of rock have been laid bare and cut through by the powerful wearing back of its waters, that an unusually good opportunity is afforded, not only for the study of their present condition, but for well-founded speculations and theories concerning their past history, and the length of time involved in attaining to their present status. Having, in my wanderings, noticed one item that has an important bearing on these speculations and theories, I have thought that an account of it might be interesting to readers of the *Science News*.

Imagine the Niagara River in its stupendous canyon, boiling and foaming in its rapids about a mile below the Falls. Suddenly it encounters a high bank or escarpment of clay in its northward course. The angry waters recoil, and, whirling, find an outlet back up stream, some sixty rods, through a narrower channel, which opens out, on the east side of the canyon, at nearly right angles to the course of the river hitherto. This is called the Whirlpool.

This curious, not to say anomalous, conformation of the banks of the mighty stream, has naturally called forth much careful observation and speculation concerning its geologic history.

The first inquiries that would occur to one who was to undertake this study would be, first, Why does the river make this sudden deviation from its direct northerly course, towards the lower level of Lake Ontario? Second, why should this obstruction, that appears to prevent this direct course, be of clay, instead of the rock precipice which everywhere else constitutes its banks?

It is found, upon examining this earthy obstruction, that there is, under the drift-soil, an actual continuation of the rock-channel in the same northerly direction that the river has previous to its deflection eastward. This is made manifest by the fact that a short, deep, and heavily wooded valley is washed out, on the western side of the mostly filled rock-gorge, by a small stream running northward, emptying into the whirlpool, the branches of which have laid bare portions of the brink and upper part of the precipice which was formed by the wearing of the ancient river.

Further investigation has shown that this gorge can again be seen some miles to the northward, at the small village of St. David's, where the ancient river left the higher plane of limestone rock, through which its gorge had been cut, flowing on through the lower land of the Ontario basin. Moreover, soundings near the lake-shore demonstrate that there is the termination of an immense gorge under water, at a considerable distance west of the present mouth of the river.

In view of all these facts, geologists have unanimously come to the conclusion that the filling-up of this ancient gorge was accomplished by an immense glacier coming down from the north at the time of the glacial age, compelling the waters of the river to find another outlet to the ocean, and that at the time of the recession, or melting away of the glacier, the river was turned to the eastward at the locality of the present whirlpool, causing it to cut back a new gorge in comparatively modern times.

Another interesting question touching the conformation of the land in pre-glacial times, arises in regard to the relative height of the two great lakes that the river connects. Was Lake Ontario higher, or lower, than at present?

The discovery of ancient lake-borders or beaches around it, much higher than the present level of the waters, demonstrates that there have been long periods when it was much higher than at present, and that the Falls must have been correspondingly diminished in height. Another fact pointing in the same direction is one that I have recently discovered; viz., that *the ancient, undisturbed rock-bottom of the old gorge is seventy-one feet higher than the surface of the waters of the Whirlpool.*

It is evident, that, if the surface of Lake Ontario was as low as in modern times, the gorge cut by the river would have been as deep as that which is cut by it at the present day; but, that not being the case, we must infer that the pre-glacial falls were much less than the present.

About the middle of August, 1886, I made a solitary foot-journey to the old gorge, which is within three miles of my present home. I entered the before-mentioned wooded valley on the west side, within less than a quarter of a mile from the point where it opens out southward into the Whirlpool. The sides of the ancient gorge, evidently laid bare by the small stream that trickles at the bottom, are precipitous and difficult of ascent, and covered with moss and lichens. I should judge its depth must be as much as one hundred and fifty feet. I chanced to light upon the only spot in it where the ancient bottom was laid bare by the stream. All above and below that place was *débris* of bowlders and gravel. It consisted of eight or ten square rods of bare limestone rock, and an abrupt descent at its southern edge, of about twelve feet, over which a considerable cascade must pour in times of high water. This stratum of limestone appeared to have been worn down to about four feet in thickness at the edge; and underlying it, as could be seen on the perpendicular side back of the falling water, was a stratum of green shale, both rocks probably belonging to what is called the Clinton group. I ascertained, by levels taken at a subsequent visit, that this bottom of the old gorge is seventy-one feet above the surface of the river at the Whirlpool at a time of low water.

I have deemed this discovery of some value in a geological point of view, inasmuch as, since making it, I have read some very elaborate speculations based on the idea that the bottom of the old gorge was at least much lower than the present surface of the river.

H. J. Seymour.

Niagara Falls, N.Y., *Jan.* 6, 1887.

THE SUPPOSED PARASITES OF THE HOUSE-FLY.

Editors Popular Science News:

I was much interested in the article, in the December number, upon the "Supposed Parasites of the House-Fly." I have noticed these for several years past. They are easily discerned (i.e., as to their existence) with the naked eye because of one striking peculiarity that your article does not mention. They are of a *bright-red color;* and I have always found them under the wings, next to the body, whence the fly could not dislodge them. I have found as high as seven on one fly, and frequently examined them with a microscope, but never so minutely as Mégnin. In my study-room I have fancied that flies having them could be detected by their peculiar actions, such as apparent uneasiness and muscular twitchings; and suspicions as to the actual existence of these creatures upon them, have been verified by catching the flies and examining them. I had thought, from their location, that they were parasitic, and even now can hardly believe that they do not derive *some* nourishment from close contact with that delicate part of a fly's organism. The fact that my examination was confined to the time of their full development, and not to their embryonic stages, may have led me to the above conclusions; while an earlier and more thorough course of observation would doubtless justify the conclusions of Mégnin.

Yours truly,

C. J.

Brunswick, N.J., *Dec.* 18.

LOONS' TEETH.

Editors Popular Science News:

I offer the following to Dr. Landrey, as to the pebbles in the loon's gizzard. They are probably the small, white, hard, slightly corrugated, amorphous substances found in the head of the cod and perhaps other fish. There are two in each head, and the resemblance to the human incisor teeth is quite plain.

I have seen boys carrying them in their pockets for "lucky bones," and presume the doctor can get a supply from any fishing-place. If not, I advise him to try a cod's-head chowder.

I have seen these bones quite one inch in length by one-fourth wide; and, if any of your readers will find tools and skill enough for the coast Indians to perforate them, perhaps the secret of a peculiar shell used as wampum by the Indians may be found out.

I have not the facts now by me; but I believe the early settlers found one species of wampum in use, and highly valued among the aborigines, made of a small, white shell, the like of which was not to be found on the shores, nor was it ever discovered.

Edw'd P. Roche, M.D.

Bath, Me., *Jan.* 3, 1887.

Our thanks are due to Dr. Roche for specimens which agree with the above description. — Eds.

TEST FOR ADULTERATED BUTTER.

Editors Popular Science News:

I notice, in the last issue of the *News*, an inquirer asks for a simple test for distinguishing adulterated butter from the genuine article. Nearly all the butter used in this market is made in California, and is adulterated to the extent of about one-half. By placing this butter in a deep vessel, preferably of glass, an ordinary test-tube will do; and allowing it to remain near the fire, where it will keep melted for several hours, and then allowing it to solidify, there will be about half of the contents of the tube pure butter, which will be on top, while the remainder will be the adulteration, — tallow, lard, or whatever it is. It can be easily distinguished, as the butter will be yellow, and the lower substance white.

Henry P. Ewing.

Mineral Park, Arizona, *Dec.* 26, 1886.

The production of refined burning-oil in Baku for the year 1885 was 3,214,285 barrels; of lubricating-oil, 185,714 barrels; and of residues, 3,642,857 barrels.

QUESTIONS AND ANSWERS.

LETTERS of inquiry should enclose a two-cent stamp, as well as the name and address of the writer, which will not be published.

INQUIRIES sometimes unavoidably remain unanswered till the issue of the second number after they are received.

QUESTIONS regarding the treatment of diseases cannot be answered in this column.

T. H. P., *Massachusetts.* — What is formic acid? and is it poisonous when taken internally?

Answer. — Formic acid (H CO OH) is found in the bodies of ants, whence it derives its name, and also in the stinging nettle. It is made on a commercial scale by heating glycerine with oxalic acid. The dure anhydrous acid is very corrosive and irritating, but, when diluted, is occasionally used as an external application. It should never be taken internally except under a physician's direction.

M. N. C., *Connecticut.* — We presume that ocean-steamers are painted black to avoid the expense of white lead, and also because the white paint would soon become soiled and discolored by iron-rust, etc. As you suggest, if they were painted white, it would tend to prevent collisions at night by giving warning of the approach of another vessel.

J. M. K., *Ohio.* — Please explain what causes a lamp-chimney to become coated with vapor when the lamp is first lighted, and its subsequent disappearance.

Answer. — One of the products of the combustion of oil is aqueous vapor, or steam. When the lamp is first lighted, the cold chimney condenses the vapor to water, which is deposited in the form of dew, and is evaporated again as soon as the chimney becomes hot.

V. C. D. inquires for a recipe for an ink which will fade away in a few days. It is said that a mixture of starch-paste and tincture of iodine possesses this property, but we doubt if any substance will disappear so completely as to leave no traces whatever upon the paper.

M. S. P. — It is said, that, when a burning taper is set under a glass cylindrical vessel in a pan of water, it will burn till the water has risen in the cylinder one-fifth of its height, and that this is proof that but one-fifth part of our atmosphere is oxygen; also that the oxygen has combined with the carbon, forming carbonic-acid gas. (1) Is there any free oxygen left above the water? (2) Has any of the nitrogen been used? (3) Has the carbonic-acid gas formed any space above the water? and what proportion? (4) In time would it acidulate the water in any degree? (5) Would the carbon and oxygen separate in time, leaving the oxygen free to fill the space it once occupied? (6) What are the ashes of burnt oxygen?

Answer. — (1) With an ordinary candle, yes; with a piece of phosphorus such as is usually used in this experiment, only a minute amount. (2) No. (3) In the case of the candle, the carbonic-acid gas formed occupies just as much space as the oxygen, previous to its combination with the carbon; but if phosphorus is used, the oxygen is condensed into the solid phosphoric anhydride (P_2O_5), and occupies no appreciable space. (4) Carbonic acid is soluble in water, and renders it very feebly acid. (5) No. (6) Usually, in the process of combustion, oxygen unites with hydrogen or carbon, forming water or carbonic dioxide for its "ash;" but it also unites with every other element except fluorine, forming analogous compounds. The exact composition of the air by volume is 20.93 parts of oxygen and 79.07 of nitrogen. The cause of the water rising in the vessel under which the candle is burning, is principally due to the expansion of the air by heat, a part of which is driven out through the water, and its subsequent contraction when the candle is extinguished.

Constant Reader. — Blackheads and similar blemishes on the skin can best be cured by keeping it in a clean and healthy condition. Many physicians recommend that the face as well as the hands be washed daily with some pure soap, and the use of a flesh-brush on other parts of the body will also be helpful.

H. M. P. — The source of the parasites which trouble your canary-bird, like that of the buffalo-bug and many other insect-pests, is a difficult question to answer. But, unless we assume a "spontaneous generation," they must have been brought from some outside source, which it is usually impossible to trace.

B. N. G. — The volume of gases varies inversely as the pressure. As the pressure of the atmosphere at the sea-level is about fifteen pounds to the square inch, an additional pressure of fifteen pounds upon any gas will reduce its volume one-half.

LITERARY NOTES.

The Education of Man. By Friedrich Froebel. Translated by Josephine Jarvis. Price 65 cents paper, $1.30 cloth. A. Lovell & Co., New York.

All persons interested in the kindergarten system of education will read this original work of its founder with the greatest interest. The methods of Froebel are constantly coming more and more into use; and the low price at which this most excellent translation is offered, places it within the reach of all.

November. Through the Year with the Poets. Edited by Oscar Fay Adams. Boston: D. Lothrop & Co. Price 75 cents.

With the present volume this admirable series is brought to a close; and it is not too much to say, that, of the seventeen hundred poems which make up the twelve issues, there is not one that does not richly deserve its place, and not one which could be spared from the collection. The editor's wide acquaintance among the poets has enabled him to secure many original pieces, which give a peculiar value to the series.

Mr. Adams has also edited a volume of *Poet-Laureate Idyls and other Poems*, containing some most amusing travesties of Tennyson's Arthurian epics, in which the familiar nursery legends of "Mother Goose" are amplified in mock heroic verse. There are also many other delightful poems of a more serious nature, which all lovers of good poetry will peruse with great pleasure.

The Interstate Publishing Company, Chicago and Boston, has published a volume of readings and recitations of high character for elocutionary drill and memory work in grammar and high schools. It bears the title of *Standard Selections*, and is compiled by Mr. John D. Billings, principal of Webster School, Cambridgeport, Mass. The selections have been made with excellent taste, and include such authors as Longfellow, Dickens, Tennyson, Addison, Lowell, Holmes, Phillips, Webster, Whittier, Everett, etc. *Standard Selections* is printed in large type, and makes a very attractive volume. Price 60 cents.

The same Company also publish a very valuable manual, prepared by a teacher of experience, and one thoroughly familiar with the needs and tastes of children, entitled *Schoolroom Games and Exercises*, by Elizabeth G. Bainbridge. The author believes that the introduction of such exercises as the book contains will not only rest the pupils, but will brighten their faculties, concentrate their attention, and strengthen them for a renewal of more difficult mental work. Price 75 cents.

The Physician's Handbook for 1887 is published by W. A. Townsend, New York, at $1.50. This work has now been issued for over a quarter of a century, and, while always valuable, has recently been thoroughly revised, and is now the most complete work of its kind extant; combining, as it does, a ready book of reference and a diary, all in such a condensed form as to be conveniently carried in the pocket. It contains features entirely different from publications of a similar nature, and has been honored with most favorable notices from the American and European medical press.

D. C. Heath & Co. of Boston announce for publication, soon after Jan. 1, *A Synopsis of the Nature and Effects of Alcohol and Narcotics*, by L. H. Luce, M.D., who, in the course of twenty years' practice, has given a great deal of time and attention to this subject.

Morse's First Book of Zoölogy is published by D. Appleton & Co., New York, at $1.25, and is intended for the use of beginners in the study of natural history. It is admirably adapted to interest the young in the subject, since it treats of the familiar forms of life which are daily brought under their observation, and instructs them how to collect and preserve them, teaching by actual inspection and observation rather than by dry formulas.

Cupples, Upham, & Co. of this city have published, in pamphlet form, Professor Smyth's argument in the famous "*Andover Heresy Case*," recently tried in Boston. The widespread interest which this *cause celebre* has excited in religious circles renders the publication of this masterly exposition of modern theology exceedingly timely.

The Report of the United States Fish Commissioners for 1884 is a continuation of that for 1883, and treats principally on the same subjects, — the propagation of food-fishes, and an inquiry into the cause of their decrease. In addition, it contains many papers of the highest scientific interest, and much valuable information regarding the fisheries of foreign countries.

Pamphlets, etc., received: *Biennial Report of the Alabama Insane-Hospital at Tuskaloosa: Plan of Study for the Assistant in Pharmacy*, by A. B. Prescott, Ph.D.; and *Circular No. 1, 1886, of the National Bureau of Education.*

Medicine and Pharmacy.

SOME FACTS CONCERNING THE HUMAN BRAIN AND MENTAL PHENOMENA.

I.

WE are indebted to modern science for a better knowledge of the relations of the spinal cord to the brain, the nature and substance of the brain, the functions of the various ganglia, and for the correction of some of those fallacies relating to portions of the organ formerly considered as vital in their importance. By the brain — or encephaloid, as it is sometimes called — is meant all that portion of the nervous system situated within the cavity of the cranium. It is made up essentially of two masses, the cerebrum and cerebellum, with several smaller ganglia, and the connecting medium between it and the spinal cord, — the *medulla oblongata*. The whole nervous system consists of two tissues, — the *white* matter, or fibrous tissue, forming the trunks of the nerves and the substance of the brain; and the *gray* matter, forming the covering of the larger portion of the brain, and found also in the central parts of the spinal cord, and forming all the ganglia of the nervous system. Reduced to its simplest elements, the nervous system consists of *nerve-cells* and *filaments*. The ganglia may be said to *originate* nervous power, while the filaments and the nerves *transmit* that power.

The average weight of the brain at its full maturity is forty-seven ounces, that of the female organ being some four or five ounces less. The weight of the brain is found to be absolutely greater in man than in any of the lower animals, except the elephant and the whale; that of the elephant ranging from eight to ten pounds, and that of the whale, in a specimen of that animal seventy-five feet long, weighing five pounds.

There has been much discussion as to the bearing of the size of the brain, in different individuals, upon the excellence of the intellectual faculties. One thing, however, seems certain, — that when the weight of the brain of the adult does not exceed thirty-two ounces, it is invariably accompanied either by idiocy or some degree of mental disturbance.

The lightest human brain on record was that of an idiot boy, which weighed only eight ounces, while that of an idiot woman was ten ounces in weight. It is interesting to notice the statements concerning the weight of the brain in certain distinguished individuals. Thus, the brain of Baron Cuvier weighed something over sixty-four ounces, that of Dr. Abercrombie sixty-three ounces, and that of Duypreten sixty-three and a half ounces, while the brain of Schiller, examined by the celebrated German anatomist Carus, did not exceed the average weight. Descartes, Raphael, and Voltaire had small heads, while the head of Napoleon only slightly exceeded the mean dimensions. The weight of Webster's brain was the same as that of Cuvier.

The average weight of the brains of Eng-

lishmen is about forty-nine ounces, that of Frenchmen a little over forty-five ounces; of Dutch, Italians, Swedes, and Lapps the weight comes nearer the English, while the German brain is heavier. Among the Hindus, and other races of India, the weight is from forty-one to forty-four ounces, but Mussulmen have more. Travelling towards China the weight increases. In Africa it is forty-three, and in America forty-six, ounces.

If, therefore, intellectual capacity depends upon the weight of the brain, the best intellect should be found in England and Germany, and the north of Europe.

It is evident, however, that something more than mere weight of the brain is necessary to intellectual superiority, since the brain of an imbecile recently examined, whose defect was congenital, weighed fifty-five ounces. Intellectual power depends more upon the extent of the convolutions and the disposition of the gray substance than upon weight, though, as a rule, the weight corresponds with the mental development. Comparative anatomists have taken great pains to compare the brains of the higher orders of apes, in their relations in form and size, to the human organ; and it must be confessed that in some specimens the surface of the brain of the monkey exhibits a sort of skeleton map of man's, and in the manlike apes the details become more and more filled in, until it is only in the minor details that the brain of the chimpanzee or the orang can be structurally distinguished from that of man. But we must bear in mind the wide difference in the size of their brains, for, notwithstanding the greater bulk and size of the gorilla, the largest brain of this animal ever weighed has not exceeded twenty ounces; while we have seen that the human brain cannot perform its normal functions if its weight be less than thirty-two ounces. There is, however, less apparent difference between the brain of the Bushmen and the higher order of ape than that existing between the ape and the lower order of animals.

It is a curious fact that the great mass of the brain, with all its ganglia of gray matter, forming the medium of intellectual power, is entirely without sensation. Mechanical irritation does not produce the slightest convulsive movement on the muscles below. The only portions of the brain that are followed by convulsive movements by irritation are the lower and central portions, forming the continuation of the spinal cord. And these are the only portions of the organ that give rise to *painful* sensations when irritated. The most central portions of the nervous system, particularly the gray matter, are destitute both of excitability and sensibility. It is only those portions which serve to *conduct* sensations and nervous impulses that can be excited by mechanical irritation. This has been illustrated by trephining, where mechanical injury has resulted in the loss of a portion of the brain, without producing any material injury after the operation alluded to.

A striking instance of recovery after severe injury of the brain, is found in the well-known case of the man whose head was pierced with a tamping iron, caused by a premature discharge in blasting a rock. The case was reported several years since by Dr. H. J. Bigelow in the *American Journal of Medical Science*. The rod, or tamping iron, was three feet and a half in length, an inch and a quarter in diameter, weighing thirteen pounds and a quarter. The bar entered the left side of the face, just in front of the angle of the jaw, and passed obliquely upward, emerging from the top of the frontal bone. The bar was found several rods from the place of accident, having passed its entire length through the wound. The man was, of course, stunned in the first instance; but he soon recovered sufficiently to converse intelligently, rode home, a distance of several miles, and his recovery was speedy and complete. The man, who was a Vermont farmer, has since died, and his skull and the tamping bar can be seen in the museum of the medical school of Harvard University.

THE EFFECT OF HIGH ALTITUDES UPON THE PULSE.

The sphygmographic tracings given below are copied from those obtained by Dr. Rey of Paris during two balloon ascensions, and show very plainly the effect of the reduced atmospheric pressure in diminishing the arterial tension. In Fig. 1 the lower line shows the pulse-tracing taken at the height of eighty-four hundred feet, while beating ninety-five times a minute. The upper tracing was taken one hour after reaching the ground. The sphygmograph was attached to the right radial artery of the aeronaut, who was accustomed to balloon ascents, and presumably unaffected by the excitement of the situation.

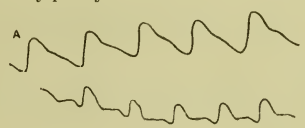


Fig. 1.

The tracings shown in Fig. 2 were also taken from the right radial artery; the first during the inflation of the balloon, and the second when it had reached an altitude of over ten thousand feet. Although these were taken from a different person, the effect of the high altitude seems to be nearly the same in both cases. Dr. Rey notes particularly that the line of ascent is practically the same at all altitudes, but that the summit of the pulsation forms a less acute angle at the higher level, and the descending line shows a much more marked irregularity, while the time of the entire pulsation is considerably shorter. The difference between the normal pulses of the two aeronauts is also worthy of note.

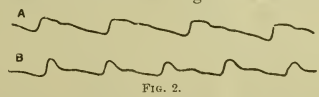


Fig. 2.

EXPLOSIVE MEDICINES.

A writer in the *Fireman's Journal*, in a series of letters on spontaneous combustion, takes the ground that this is a more common cause of fires than is generally supposed. Incidentally he refers to what has more than once been discussed in the *News*, — the explosive combinations of drugs in physicians' prescriptions, some of which show a lamentable ignorance or carelessness on the part of medical men. They ought to know the chemical as well as the therapeutical properties of the agents they prescribe, and not to order the preparation of mixtures that are sure to be more or less combustible or explosive. It is a familiar fact in chemistry, that highly oxidized substances, like chlorate and permanganate of potash, chromic acid, sundry chromates and nitrates, metallic oxides that part readily with their oxygen, and iodine or chlorine when mixed with ammonia, are apt to form explosive compounds. If we put iodine in strong aqua ammonia, and let the black substance which is formed, dry on a piece of paper, it explodes as soon as it is fairly dry, and a sudden jar will often set it off while it is yet moist. This fearfully explosive iodide of nitrogen is formed when tincture of iodine and ammonia are mixed, as is not unfrequently done in prescriptions; and, were it not for the large quantity of water present, explosions would often be the result. Chlorates and nitrates are particularly liable to explode when mixed with glycerine, tannin, or sugar; and lozenges containing such combinations have often exploded in the pocket, and sometimes even in the mouth, on coming in contact with particles of carbonaceous tooth-powder. A doctor may occasionally be justified in "blowing up" an obstinate or disobedient patient, but not in this literal manner.

MONTHLY SUMMARY OF MEDICAL PROGRESS.

COMPILED EXPRESSLY FOR THE SCIENCE NEWS BY W. S. WELLS, M.D.

A series of cases of tumors located upon the neck are given by Dr. H. W. Boone, surgeon to St. John's College, Shanghai, China.

He writes that the medical missionary in charge of a hospital in China soon learns that his own reputation and that of his institution depends upon his success in the surgical operations he may undertake. As elsewhere, nothing is so successful as success; and, as the foreign surgical operator is assisted by Chinese students, there need be no fear but that China will, in time, develop able surgeons, as she has already shown her capacity to adopt other innovations.

Dr. Boone says, that, as regards tumors of the neck, the very first thing which impressed him was, that the mere external appearance of a growth gave no indication whether or not it would be easy to remove. The largest tumor of the neck he ever saw — larger than the patient's head — was removed, without the slightest difficulty, by simply peeling it out of its bed, as one would peel an orange from its skin. Not a single vessel was tied or twisted, and the loss of blood was insignificant. On the other hand, a tumor apparently small, showing but little on the surface, may send

prolongations so far into and among the deeper structures of the neck, as to involve a most tedious and formidably bloody operation for its removal.

Sometimes, after careful and repeated examination from within the mouth, by placing the head in various positions, causing the patient to swallow, pressure on the carotid, and the use of other means to come to a correct opinion, one finds but little really diagnostic has been learned; and the important questions as to the limits of the growth, its point of origin, and whether or no it is deeply connected with important structures in the neck, may, one and all, be involved in as much uncertainty as before examining. In these cases one is quite justified in making free exploratory incisions, and attempting the removal of the tumor; but the patient should always, beforehand, be given to understand, that, if at any stage of the operation it is found impossible to excise the tumor safely, the operation will be abandoned, and the wound closed.

The wounds made will heal, without any fear of after-trouble, by using antiseptic dressings, with drainage-tubes and absolute immobility of the parts involved.

LAST year a hospital ward in London and one in Paris were set apart for experimental practice with the several forms of electric currents for the cure of various abnormal conditions.

For several years the practice has been pursued in the United States, with remarkable success; and testimony is constantly increasing in favor of electrolysis for arresting the growth of tumors, and causing their absorption and disappearance, without pain or any dangerous sequel.

At the late French Surgical Congress, Dr. Apostoli read a paper, urging his claims to the electrical treatment of uterine fibromata. Without presuming to determine who is entitled to priority of discovery, it is certain that fibroid tumors of the womb were successfully arrested, and their absorption obtained, by electrolysis, in this country, several years ago; and the practice has extended, in the mean time, to various other diseases. The writer has applied the electrolytic process to the arrest and absorption of fatty tumors and other growths; and its use is quite common here for the relief of urethral strictures and certain dermal diseases.

In one case, that of a tumor upon the side of the face, known commonly as a "wen," the writer inserted a common sewing-needle into the growth, and attaching the negative wire of an electric battery to it, and allowing the patient to hold the positive electrode in his hand, gradually turned on the current to only six cells, and allowed it to pass for about twenty minutes, causing no special discomfort. The current was then discontinued, the tumor having become white and quite firm. There was no blood, no pain; and the patient walked off, returning in about three weeks with scarcely a trace of the growth, which at the time of the operation was as large as a good-sized plum. Now, over a year since, no signs of its existence can be detected by sight or touch. Only the one treatment was resorted to, no repetition of it being necessary, and no local medication other than the electric current.

This method will strike most people as decidedly preferable to extirpation with the knife; and it is equally applicable to the quiet, painless dispersion of moles, birth-marks, hairy growths, and other disfigurements so often seen upon the face and other parts of the body.

A SINGULAR case is reported as occurring in a negress who had a large cavity in one of her teeth, and had been in the habit, for a long time, of plugging it with cotton. These pledgets from time to time became loosened while eating, and were swallowed with the food, and, accumulating above the ileocæcal valve, were attended with severe pain and a gurgling sensation. Purgative doses of aloes and castor-oil brought away the offending masses of cotton plugs, and since then her general health has materially improved

THE above case reminds us of the ingenious device of a dentist whose patient swallowed, during sleep, her artificial teeth, consisting of a rubber plate with six teeth, and gold clamps for fastening to the natural ones.

With much difficulty the set reached the stomach; and the dentist, apprehending the peril of so large and irregular a substance, with its sharp points and curved clamps, making the voyage through the bowels, induced his patient to swallow a considerable quantity of cotton threads cut into small pieces, and mixed with the white of eggs beaten to a froth. The object was, to have the bits of cotton, steeped in the white of eggs, wrap themselves around the sharp points of the plate, thus rounding them off, so as to prevent scratching and wounding the bowels during the transit.

The result was eminently successful. Four days later the patient brought the plate, and it was found to be completely enveloped and overspun by the cotton threads, and so protected that no pain or other inconvenience had been experienced during its passage through the intestinal canal and final exit.

A CASE of elephantine enlargement of the legs is reported, in which their enormous size was greatly reduced and kept down by the regular use of an ointment made with one drachm of nitrate of mercury and one ounce of vaseline. This was rubbed in thoroughly and frequently, followed by enveloping the limbs, from the toes up, in rubber bandages.

IT is not uncommon to meet with persons whose finger-nails split and break so easily as to give rise to much annoyance. Dr. Irquhart relates his own experience, having had this condition of his finger-nails result, as he ascribes, from scurvy contracted in the military service. He anointed the nails daily with oleate of tin, and at night enveloped them in the oleate spread on flannel bandages. In about two months all the nails became sound and tough, and the same result followed his use of it in other cases.

IT is well known that enlargement of the glands in the neck may co-exist with cancer of the œsophagus, lungs, pleura, or other organs within the chest; but it has only lately been observed, by several German and French surgeons, that enlargement of the glands in the neighborhood of the collar-bone may be present as an accompaniment of cancer of the stomach. Sometimes one gland only was swollen and tender, sometimes more than one; and they were not adherent to the surrounding tissues, but could be moved by pressure. Of course, these can only, by their enlargement, strengthen the clinical history of any case, but when present, together with symptoms of cancer of the stomach, are considered valuable auxiliary indications.

THE HYGIENE OF CYCLING.

ACCORDING to Dr. Kunze of Halle, cycling is a health-stimulating exercise, which ought to be commended by medical men. It is a powerful means of strengthening the human body, and may even be considered an exercise acting as a preventive and curative, of no mean order, of certain bodily ailments. The velocipedist (especially the bicyclist) learns, first of all, the art of balancing himself, by practising it on an instrument as sensitive as it is easily overturned. To acquire it, it is necessary to call into precise action certain muscles, every individual muscle being trained to do its particular work. Those who are thrown from a bicycle, as a rule, do not yet possess the required ability to balance themselves. This latter acquirement is of great use also in practical life. Those who possess it will be able to jump ditches with greater precision and safety, pass along narrow paths, mount more difficult staircases, climb up and descend precipitous mountains, and will also carry themselves more erect, than those who do not possess this power of preserving an equilibrium. A further effect of velocipede-riding is to strengthen the muscles, not only of the lower extremities, but also those of the abdomen, the chest, and the arms, which are constantly being excited to contract. The muscles of the lower extremities contract and relax in the action of propelling the velocipede, and there is no other movement which requires such rapid and energetic contractions. We frequently find that the muscles of the thigh and lower leg of cyclists increase in size, and consequently cyclists are able to bear, without fatigue, long walking-tours. As, however, every organ which becomes stronger is less liable to disease, strengthened muscles predispose velocipedists less to ailments than the relaxed muscles of non-velocipedists. It would be highly interesting if reliable statistics could be obtained from the various cycling clubs, showing whether and how frequently muscular rheumatism of the thigh, for instance, is met with among velocipedists. The effect of cycling exercise upon the abdomen is of very special importance. With the contractions and relaxations of the muscles of the thigh, those of the abdomen stand in close relation; and it is evident that the latter must be equally benefited. Upon the chest, cycling exercise acts in two ways. In the first place, by the contraction of the muscles of the abdomen, the stagnant air in the lungs is more thoroughly expelled; and, in the second place, the apparatus of breathing is more powerfully acted upon by the greater difficulty of respiration and aspiration experienced in quickly propelling the velocipede. The more effectual expulsion of the stagnant air from the lungs must be of favorable influence upon the change of matter in the human body, in so far as the entry of air into the lungs is thereby increased, oxygen forming one of our most important means of nourishment. Those who wish to expand their chests, Dr. Kunze says, should mount a velocipede. — *Germantown Telegraph.*

DIGESTION OF STARCH.

PROFESSOR DUJARDIN-BEAUMETZ is reported as follows in the *Therapeutic Gazette:* —

"The transformation of starch into sugar is not as simple as one might imagine at first sight. The supposed breaking-up of the starch molecule into one molecule of dextrine and one of grape-sugar is not a representation of the reality, if we may trust the experiments of Musculus, of O'Sullivan, of Brown and Heron, and of William Roberts.

"According to these experimenters, we must consider this reaction as much more complex, and as terminating by the formation of maltose and achrodextrine.

"Ewald, of Berlin, has recently studied the influence which saliva exercises upon the saccharification of amylaceous matters in the stomach. He has shown that the transformation of starch into sugar is effected to a very trifling extent in the stomach,

and that, after the administration of a concentrated decoction of starch, you may note the presence of fermentable dextrine and maltose, but that the metamorphosis of maltose into sugar takes place only in the intestine. If to the facts attested by Ewald we add that the pancreatic juice furnishes a ferment adapted to the digestion of amylaceous matters, we are warranted in the conclusion that starchy substances are exclusively digested in the intestine.

"There is always an interest in knowing (and this especially with reference to the treatment of certain affections, and glycosuria in particular) the quantity of starch contained in cereals as vegetables. The following table, from Nedats, gives the percentage of starch in wheat, rye, potatoes, etc. : —

	Per cent.
Rice	74.10
Indian corn	65.90
Wheat-flour	63.00
Whole wheat	59.60
Rye-flour	59.84
Millet	59.90
Buckwheat	50.00
Wheat-bread	42.70
Oatmeal	39.10
Peas	37.00
Rye-bread	36.25
Beans	36.00
Jerusalem artichokes	16.60
Potatoes	15.50

"You have seen, by the foregoing table, how small a proportion of starch is contained in potatoes. In this respect the vegetable occupies a low place : hence the applicability of potatoes to the dietary of diabetes.

"Without entering here into the details and complex chemical reactions of bread-making, I must call your attention to the nutritive value of bread. In this respect it is important to distinguish the crust from the crumb; the crust is much the more nutritious, as shown by the analysis of Barral.

"It is generally believed also that bread made from the coarser, inferior flours is more nutritious than bread made from the superfine flour. This is a mistake; and Violet has shown that the finer and whiter the flour, the more nitrogen it contains."

[This does not include the phosphates and mineral substances, which are more abundant in the outer coatings of the grain. — Eds.]

CHRONIC CONSTIPATION.

At a recent meeting of the Chatham (Canada) Medical Society Dr. Backus read a paper upon this subject. In relating the numerous causes of chronic constipation, he headed the list with carelessness and neglect. A hurried and imperfect performance of the act of defæcation, necessitating an incomplete emptying of the lower bowel, is mischievous. Change of residence, of occupation, of diet, or an attack of some severe illness, may be the origin of the disease. Deficient secretion from the mucous membrane of the large intestine, or an excessive drain upon the fluids of the body, as in diabetes, render the fæces hard and less easily moved by the peristaltic action of the bowels. Anæmia and other enfeebled conditions of the system frequently give rise to constipation, etc. The result of continued constipation is often pernicious : the blood is burdened with effete material ; mental depression, melancholia, dyspeptic conditions, a sallow complexion, often persistent and severe pains referred to the back, hips, etc., may follow. Sciatica may be due to constipation. Referring to the treatment, Dr. Backus divided it into hygienic, dietetic, medicinal, and mechanical. Under hygienic, he spoke of exercise, walking and riding, massage of the abdomen and general massage in persons unable to take active exercise, and bathing, as conducive to a permanent cure. Under dietetics, he forbade the excessive use of meat or a too nutritious diet, and advised more vegetables, fruit, and coarse breads. Some people took too little fluids, and a more liberal supply of water frequently relieved them. In the medicinal treatment of these cases, he thought usually a combination of drugs in small doses acted better than a single one. He enumerated succinctly the indications for the more important purgatives. He had found, in some of the most obstinate cases of constipation in children, cod-liver oil act with great satisfaction. He had not found cascara sagrada to be a specific. A pill he found useful in many cases is one containing sulphate of iron, aloes, colocynth, nux vomica, and belladonna. Under the last heading he noticed the various enemas and suppositories useful in constipation. In all cases, patients must be urged to solicit a motion of the bowels at the same hour daily; the persistent practice of this rule would cure the majority of cases. — *Canada Medical and Surgical Journal.*

THE MEANS OF PREVENTING THE DETERIORATION OF RUBBER APPARATUS.

An inquiry has been carried out, under the direction of the French Minister of War, with the object of ascertaining the cause and the remedy for the peculiar changes which articles made of india-rubber undergo when kept in stock; the annual loss to the government from the deterioration of this class of goods being very considerable. Experience shows that india-rubber, after a time, loses the very qualities which makes it useful, for it becomes dry and brittle. Articles kept in boxes, such as Higginson's syringes, Esmarch's bandages, and drainage-tubes, are particularly liable to deteriorate, as are also the insufflation bulbs so largely used in connection with spray-producing apparatus and thermo-cauteries. Unfortunately, the results of a long and patient investigation are not by any means satisfactory, so far as the discovery of a means of prevention is concerned. Nevertheless, certain precautions are advised, both in the quality and storage of india-rubber goods, which, it is hoped, will do something to minimize the loss. The commissioners advise, for instance, that Esmarch's bandages should be taken out of the boxes at least once a month, unrolled, and manipulated. Drainage-tubes should be hung up in a cool place, or soaked in a non-putrescible fluid. Finally, all objects made of rubber should be kept in a cool, damp place, at a constant temperature, and sheltered from light, heat, and frost. Seeing that, in many cases, these conditions cannot be complied with, it is recommended that the bandages should be made of pure leaf rubber, in lieu of the elastic tissue usually employed. The purer the rubber, the less readily does it undergo these structural alterations, and the lighter it weighs: its weight is therefore a sure guide to its quality. In consequence of these inquiries, the Minister has ordered that in future all rubber articles are to be made with pure rubber of the best quality, preferably with the leaf rubber. The quality of the articles will be gauged by their specific gravity, in order to insure the purity of the material employed. — *Phil. Med. and Surg. Reporter.*

POTASSIUM PERMANGANATE IN BURNS AND FROST-BITE.

In the *Meditzinsko Obozrenïë*, Dr. A. A. Züboff writes, that, having tried permanganate of potassium in forty-four cases of burns and thirteen cases of frost-bite, he arrived at the following conclusions: 1. Permanganate of potassium, in the shape of frequently changed compresses (linen or hygroscopic cotton-wool soaked in a solution of one or two grains to an ounce of water), is an effective remedy for frost-bite of the first and second degrees. 2. The same lotion acts as successfully in burns of the first degree. 3. It is less successful in burns of the second degree. At all events, the permanganate lotion rapidly relieves pain, and inflammation around blisters, and prevents suppuration when blisters remain intact. In this category of cases it is advisable to employ a weaker solution (half a grain, or even less, to an ounce). Two cases are given in detail. One of the patients received (when taking a vapor-bath) a scald of the first degree, extending from the breasts to the inguinal folds anteriorly, and between the same levels posteriorly. Pain disappeared within an hour after the application of the permanganate lotion. Soon the epidermis began to peel off. She left, well, in eleven days. Another woman had a similar scald of the face and a hand. She also obtained rapid relief, the treatment lasting a week. — *London Medical Record.*

FEES FOR EXPERT TESTIMONY.

Referring to a recent case where a physician was imprisoned for refusing to testify as an expert, without proper compensation, the *Medical Record* says : —

"We all know that law and equity are not synonymous terms; but it is certainly not justice to compel a man to give for nothing what he has spent so much time, money, and labor to acquire. If a physician has no right of possession in the special knowledge which has cost him so much to gain, then let us be consistent, and divide up all property. Physicians, in common with other good citizens, submit willingly and uncomplainingly to the law, and cheerfully make every sacrifice to perform their duty as witnesses to facts which may be of service in furthering the ends of justice. But there is a limit to even such services. It is the common belief that judges and lawyers are necessary to the proper meting out of justice to evil-doers; but they are not, on that account, compelled to give their services without remuneration, and there is no justice nor reason in forcing physicians to do so. The State has attorneys whom it pays well to prosecute offenders against its laws; and it should pay the expert witness, if it calls upon him, for the knowledge which he has acquired, and which is as much his own property as are the clothes he has on his back."

THE PURITY OF MID-ATLANTIC AIR.

In the course of an address on the "Action of Micro-Organisms on Surgical Wounds," Professor F. S. Dennis of New York states that during his last trip across the Atlantic he made some experiments to test the purity of the air about a thousand miles from land. He employed capsules of sterilized gelatine, and exposed them for fifteen minutes. One capsule was exposed in the stateroom upon the main deck of the steamer. Within eighteen hours over five hundred points of infection had developed. Two capsules exposed in a similar manner in a cabin on the promenade deck, where the circulation of air was free, showed five or six points of infection each ten days afterwards. A capsule exposed over the bow of the ship was found to be entirely uncontaminated. These experiments are on the same lines of those of Pasteur and Tyndall upon the mountain-air of Switzerland ; and, so far as they go, they show the germless condition of mid-oceanic air, and also the need for much more efficient ventilation in the staterooms of even the first-class American liners. — *Phil. Med. and Surg. Reporter.*

ARBOR-VITA IN PHOSPHURIA.

In some cases of phosphuria the patient suffers intensely from difficult and protracted indigestion, and its attendant, the so-called dyspeptic colic. Pepsin, ingluvin, and all other aids to digestion had signally failed in the gentleman whose case I am now going to relate. Almost immediately after rising from his meals the stomach distress would invariably commence. A bit of salted ham, an onion, cabbage, molasses, honey, almost any thing, would cause the pain. I suggested a tincture of *Thuja Occidentalis*, or arbor-vita, as a good remedy for his trouble. I furnished him with a vial of it; and on the recurrence, which occurred after dinner, one teaspoonful of the tincture — a saturated one, made from the leaves with pure 98° alcohol — was poured into a glass, and about two ounces of warm water added. This was taken at one draught, and the pain stopped in less than fifteen minutes, nor did it again return for nearly a year. It is as nearly a specific for phosphuric gastralgia as the whole materia medica can afford.

S. F. LANDREY, M.D.

MEDICAL MEMORANDA.

M. GOSSE has, it is said, found means to restore the lifelike expression to the eyes of dead bodies. He places a few drops of glycerine and water on the cornea, and lifelike expression is reproduced.

SUNLIGHT AND DISEASE-GERMS. — M. Duclaux has studied the influence of sunlight on the vitality of micrococci. A few hours' exposure to the sunlight weakened the pathogenic micrococci, and finally killed them. The inference is, that sunlight is a universal hygienic agent, one that is most active and powerful, common to both private and public sanitation.

TO PREVENT PITTING IN SMALL-POX. —Dr. A. S. Deane says, that, when he was physician to a large fever-hospital in Ireland, a young girl was admitted in the vesicular stage of semi-confluent variola. He was experimenting at the time on the various methods proposed for preventing pitting. The plan adopted in this particular instance was, to cover the face with a paste of whiting mixed with carbolized oil, while the patient's hands were confined in a sort of strait-jacket. The result was eminently satisfactory. No scar remained anywhere, except on the point of the chin, where the friction of the bed-clothes continually rubbed away the application.

PASTEUR is a doctor at last, having been given a degree *honoris causa*.

KASKINE, so prominently advertised of late as a substitute for quinine, is said by Dr. Hoffman to be nothing but *saccharinum album*. — *N. Y. Medical Times*.

WONDERS OF DIET. — The Roman soldiers, who built such wonderful roads, and carried a weight of armor and luggage that would crush the average farm-hand, lived on coarse brown bread and sour wine. They were temperate in diet, regular and constant in exercise. The Spanish peasant works every day, and dances half the night, yet eats only his black bread, onion, and watermelon. The Smyrna porter eats only a little fruit and some olives; he eats no beef, pork, or mutton: yet he walks off with his eight hundred pounds. The coolie, fed on rice, is more active, and can endure more, than the negro fed on fat meat. The heavy work of the world is not done by men who eat the greatest quantity. The fastest and longest-winded horse is not the biggest eater. Moderation in diet seems to be the prerequisite for endurance. — *Medical Advocate*.

A NEW ANTI-RABIES INOCULATION. — The *Medical News* says: "Dr. Fernandez of Barcelona claims to have discovered a new vaccine to preserve men and animals from the contagion of rabies. He has collected a great number of observations, showing that dogs bitten accidentally by vipers are never affected by rabies, either spontaneously or when bitten by affected animals. He has made certain direct experiments, inoculating dogs with a small quantity of the viper's poison. After inoculation, the animals were ill for four or five days with symptoms of slight fever, prostration, and more or less profound somnolence. He maintains that the animals thus operated on are protected from rabies, and that neither when inoculated with the saliva, nor when bitten by affected animals, do they contract the disease."

THE operation of compulsory vaccination was suspended in Zürich, Switzerland, in obedience to popular clamor, in 1883. The deaths from small-pox per 1,000 total deaths for the two previous years and that year had been, in 1881, 7; in 1882, 0; in 1883, 8. They rose, after compulsion had ceased to be used, in 1884, to 11.15; in 1885, to 52; and in the first eight months of 1886, to 85, per 1,000.

HUMORS.

"MY dear," said a frightened physician in the middle of the night, shaking his wife, "where did you put that bottle of strychnine?" — "On the shelf, next to the peppermint." — "O Lord!" he groaned, "I have swallowed it." — "Well, for goodness' sake," whispered his wife, "keep quiet, or you'll wake the baby."

"PLASTHERED FOR GOOD." — Patrick Collins is a teamster, and was driving through Chambers Street recently, when an axletree broke, throwing him into the street. His back struck a curbstone, and he was stunned by the violence of the fall, appearances indicating that his injury was serious. He was sent to the General Hospital, where he arrived in an improved condition. An examination revealed only a contusion, which was a result that contributed much to the elevation of Collins's spirits. A surgeon applied a plaster, telling the patient to wear it until he took his next bath. A puzzled expression, succeeded by one of native humor, came into Pat's face as he asked, "Was it a bath ye said, docther?" — "Yes," replied that gentleman, "you can remove it when you take a bath." — "Sure, then," said Pat, "I'm plasthered for good. It's but wan bath I've had these twenty-five years, an' thin I fell overboard." — *Boston Journal*.

A POPULAR physician was much pleased with a certain aerated water, and by his assiduous recommendations procured for it a celebrity it justly deserved. The doctor acted solely in the interests of humanity generally, and expected no return. To his surprise, there came one morning an effusive letter from the company, stating that his recommendations had done them so much good, that they "ventured to send him a hundred ——" Here the page came to an end. "This will never do," said the doctor; "it is very kind, but I could not think of accepting any thing." Here he turned the page, and found the sentence ran, "of our circulars for distribution."

THE BEST BEEF-TEA SHE EVER HAD. — A physician prescribed beef-tea for a patient, giving the following directions: Enclose the finely chopped meat in a glass bottle, then boil by placing the whole in a pot of water. The directions were carried out as far as boiling the bottle of meat in the pot of water was concerned; but, instead of mixing the finely chopped meat with the water, the lady gave the sick person the hot water in which the bottle was boiled, who said that she had not tasted any thing so good for a long time.

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SETH C. BASSETT,

MANAGER.

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Remittances will be duly credited on the printed address label of the paper; but if they are received after the 15th of the month, the change in the label cannot be made until a month later. If a formal receipt is desired, a two-cent stamp or a postal card should be enclosed with the remittance. Drafts and money orders should be made payable to the order of the POPULAR SCIENCE NEWS COMPANY.

Publishers' Column.

ALFRED R. WALLACE, LL.D., the well-known English naturalist, will lecture in the United States during the winter and spring. For prospectus of lectures and terms, application must be made to his agent, B. W. Williams, 258 Washington Street, Boston, Mass.

To say the right word in the right place is important; for instance, when at a stationer's to call for some of ESTERBROOK'S FALCON PENS, or any other of their popular styles.

DR. DAVID CLARK, Springfield, Mass., says: "HORSFORD'S ACID PHOSPHATE is the only proprietary medicine I ever use or prescribe."

THE GURNEY HOT-WATER HEATER is rapidly coming into favor as a means of warming buildings. Unlike steam, which is always at nearly the same temperature, the heat of water can be easily regulated to correspond with the outside temperature.

THE following recommendation refers to the ICE MACHINES and REFRIGERATING APPARATUS manufactured by DAVID BOYLE of Chicago:—

"The Refrigerator System is all it claims to be, and so far we deem it the best and most perfect in the world."

ANHEUSER-BUSCH BREWING ASSOCIATION,
A. BUSCH, *President*.

THOSE who are unable to take the common cod-liver oil, on account of its disagreeable taste, will find in HYDROLEINE an improved substitute. It is much more easily assimilated than the pure oil, as it is combined with agents that aid the digestive process.

ON the third advertising page will be found a list of standard scientific works published by BRADLEE WHIDDEN of this city, which is worthy the attention of every one.

I AM using a good deal of COLDEN'S LIQUID BEEF TONIC in my practice, and have every reason to be satisfied with it. I have found it particularly useful in the advanced stages of consumption, and in organic diseases of the liver, when the stomach has been very irritable. In pregnant women it has been retained while every other article of diet was rejected. I can recommend it as convenient, palatable, and easy of digestion.

JAMES A. SEWELL, A.M., M.D.
QUEBEC, *June* 12, 1873.

THE use of prepared food for invalids and young children has become a recognized necessity the world over. The preparation which most closely resembles mother's milk is confessedly the best food for nursing-babies, and the preparation which is most grateful and nourishing to the delicate organism of the invalid or convalescent, is destined to win the favor and confidence of the medical profession. MELLIN'S FOOD has long since been found to meet these requirements.

The Popular Science News

AND

BOSTON JOURNAL OF CHEMISTRY.

VOLUME XXI. BOSTON, MARCH, 1887. NUMBER 3.

CONTENTS.

FAMILIAR SCIENCE. — Scientific Recreations 33
Metals and Metalloids 34
Autumn Leaves: their Color-Changes and their Fall 34
The Laws of Habit 36
Scientific Brevities 36

PRACTICAL CHEMISTRY AND THE ARTS. — Nocturnal Photography 37
Ice-Palaces 37
Nickel as a Material for Dishes and Crucibles 37
A New Coal Product for tanning Leather 37
Taking Train Speeds in Prussia 37
Paris Letter 38

HOME, FARM, AND GARDEN. — The Evaporation of Water in Furnaces 39
The Mysteries of Plant-Growth 39
A Cooking Device 40
Gleanings 40

EDITORIAL. — The Genesis of the Elements 41
How an Icicle is formed 42
Astronomical Phenomena for March, 1887 43
Meteorology for January, 1887 43
Bacteria: their Classification and Relation to Higher Fungi 43
Fall of Rocks at Niagara 44
Questions and Answers 44
Literary Notes 44

MEDICINE AND PHARMACY. — Some Facts concerning the Human Brain and Mental Phenomena 45
Hunger 45
Monthly Summary of Medical Progress 46
Collective Investigation of Centenarians 47
So-called Pure Vegetable Remedies 47
The Archæology of Artificial Limbs 48
Water as a Diuretic 48
Medical Memoranda 48

PUBLISHERS' COLUMN 48

Familiar Science.

SCIENTIFIC RECREATIONS.

THE old "checker-board" puzzle is familiar to many persons, but is such a good one, that we venture to give it a place in this article, together with an explanation of the apparent mystery.

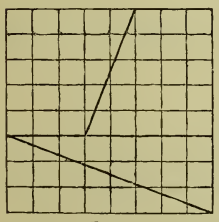


FIG. 1.

Take a square piece of cardboard or paper, and carefully divide it into sixty-four squares, as in Fig. 1. Cut it into four pieces, as shown by the heavy dark lines, and arrange them as in Fig. 2. If we now count the

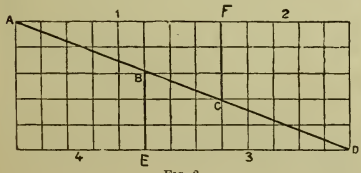


FIG. 2.

squares, we find that there are *sixty-five*, the re-arranging of the pieces having apparently added one to their number. There can be no doubt about the number of squares in the two figures; and the surface of the cardboard is, of course, the same in both cases. How, then, is the presence of the extra square to be explained?

If we closely examine the squares as arranged in Fig. 2, we shall find that along the

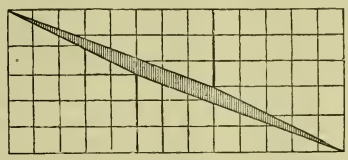


FIG. 3.

line AD the pieces of cardboard are not exactly in contact, but are separated by a lozenge-shaped space, shown in an exaggerated form in Fig. 3; in other words, the angles over ABE and DCF are not quite the same as those over DBE and ACF. This difference is so small as to be unnoticed, but it is an actual one; and a simple mathematical calculation will show that the areas of the two

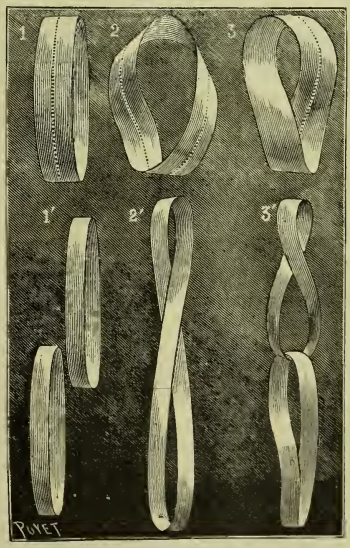


FIG. 4.

triangles which form the lozenge-shaped space are exactly equal to that of one of the squares. The apparent paradox, therefore, is really an optical illusion, and shows the necessity of accurate and close observation in scientific investigations.

Take three strips of paper, and paste the ends together so as to form a ring. Then cut around the centre, as shown by the dotted lines. The first strip will separate into two equal-sized separate rings; the second will form one large ring; while the third will be cut into two rings, linked together. The explanation of this pretty and simple trick lies in the preparation of the original rings. No. 1 is made by joining together the two ends of a strip of paper. In No. 2 the strip is twisted *once*, and in No. 3 *twice*, before joining the ends. It is better to make the rings much larger than those shown in the engraving, as

FIG. 5.

the twisting of the paper is not then so evident.

The third experiment illustrates some important scientific principles, and is a very effective and interesting one. Take two glasses, immerse them in a bowl of water, and place the edges accurately together. They may then be withdrawn full of water, and placed as shown in the cut. The pressure of the atmosphere will prevent the water from running out of the upper glass. Then take in a third glass some dilute alcohol, colored with aniline dye or common ink, and pour it slowly over the bottom of the inverted glass. It will flow down the sides until it reaches the line of separation between the glasses, when the action of capillary attraction will draw it between their edges, and the inferior density of the colored alcohol will cause it to rise in the upper glass, displacing a small amount of water; and, by continuing the experiment, the liquid in the upper glass may become entirely colored, while that in the lower glass remains clear. Of course, only a small amount of the water is

displaced by the alcohol, but the whole will become colored by the aniline or ink. We would suggest, in addition to the apparatus, a deep dish or pan in which to set the glasses to catch the overflow of the liquid.

For the engravings illustrating this article we are indebted to the French journal *La Nature*.

METALS AND METALLOIDS.

The seventy or more elements at present known to chemists, can be divided into two great classes, — the metals, and non-metals or metalloids. The metals are much the largest class, as only fifteen — or, excluding hydrogen, which is probably a gaseous metal, — fourteen of the elements are considered as strictly non-metallic. These are chlorine, bromine, iodine, fluorine, oxygen, sulphur, selenium, tellurium, nitrogen, phosphorus, arsenic, boron, silicon, and carbon.

Metals possess very characteristic properties; the peculiar lustre is familiar to every one, and the term "metallic lustre" has passed into common speech. All are perfectly opaque to light, except gold, which in very thin leaves transmits a greenish or purplish light. With the exception of gold and copper, all metals are of the same white color, which, however, in the case of lead is feebly tinted with blue, in bismuth with pink, and in calcium and strontium with yellow.

The specific gravity of most metals is quite high,—only seven have a density below 6.72, — but they vary from osmium, at 22.48, to lithium, at 0.59.

Malleability, or power of extension under the hammer or in a rolling-mill, and ductility, or the property of drawing into wire, are also peculiar to the class of metals. Gold is the most malleable metal, zinc and bismuth only partially so, while antimony does not possess the property at all. Iron is the most ductile metal, and lead the least.

Metals are of all degrees of fusibility, from mercury, which solidifies at —39.44°, through gallium, which melts at 86°, and cast-iron, at 2786°, to platinum and similar metals, which are only fusible by the oxy-hydrogen blowpipe. All are conductors of heat and electricity; silver standing highest in both cases, and copper second.

Nearly all metals are *sectile;* that is, when cut with a knife, they do not crumble before the edge, but retain their tenacity, and can be "whittled" like a piece of wood. This is a convenient test for determining whether any yellow-colored mineral is gold or not. Gold usually occurs *native*, or in the metallic state, and is perfectly sectile; while pyrites and other minerals resembling it, crumble under the knife like a lump of sugar.

Metals can be fused together, and unite with each other in all proportions, forming alloys. When alloyed with mercury, the compound is termed an *amalgam*. The exact condition of the metals constituting an alloy or amalgam is not well understood; but it is probably a true chemical combination, although the affinity must be very weak. The metal palladium will absorb 643 times its volume of hydrogen gas, by which its specific gravity is reduced from 11.40 to 11.06. This is supposed by some chemists to be a true alloy between palladium and hydrogen, and considered to indicate the metallic nature of the latter. Hydrogen has also been solidified by extreme cold and pressure, and is reported to form a steel-blue substance of metallic lustre and appearance; but, owing to the very brief time that it remains in the solid state, the observation is not fully confirmed.

The metalloids possess but few of the metallic characteristics. Those that are not gaseous at ordinary temperatures, have no metallic lustre, are usually of low specific gravity, are neither malleable nor ductile, and conduct heat and electricity very imperfectly. As a general rule, they are of an acid nature, uniting with the basic metals to form salts, although there are exceptions to this.

Nevertheless, the line between the metals and metalloids is not sharply drawn. There is a remarkable group of elements known as the nitrogen group, the members of which show a marked change from the non-metallic to the metallic class, as the atomic weight increases. The first member, nitrogen, with the atomic weight 14, is certainly non-metallic; next comes phosphorus (31), which shows but slight traces of a metallic nature; then arsenic (75), which may be considered on the border line; while antimony (120) and bismuth (210) have well-marked metallic characteristics, especially the latter. All these elements are closely related to each other, from a chemical point of view; and the gradual development of a metallic nature is a very striking circumstance, which is doubtless full of meaning, if we were only able to solve the problem.

Arsenic is noticeable as standing between the two classes. In an elementary state, it possesses the metallic lustre, and is commonly known as metallic arsenic. It also unites with chlorine and other metalloids, like a basic metal; but, on the other hand, its most characteristic properties are those of an acid-forming element. It unites with oxygen to form arsenious and arsenic acids, both true acids, capable of uniting with bases; and it forms compounds with hydrogen ($As H_3$), similar to ammonia ($N H_3$) and phosphuretted hydrogen ($P H_3$). On the whole, it is best considered as a metalloid, with strongly metallic characteristics.

While we can thus divide the elements into two great classes, the line is somewhat indefinite; and further investigations into their nature, a subject which at present is attracting much attention, may show that the division is an arbitrary one, and is simply due to accidental or superficial differences, or, on the contrary, we may find that it indicates the existence of two opposite kinds of matter, governed by positive and negative forces, possibly allied to electricity or magnetism.

At the depth of seven hundred feet in the ocean, the light ceases altogether; one-half of the light being absorbed in passing through only seven feet of the purest water.

[Specially written for the *Science News*.]

AUTUMN LEAVES: THEIR COLOR-CHANGES AND THEIR FALL.

BY FREDERICK LEROY SARGENT.

"If ever, in autumn, a pensiveness falls upon us as the leaves drift by in their fading, may we not wisely look in hope to their mighty monuments? Behold how fair, how far prolonged in arch and aisle, the avenues of the valleys, the fringes of the hills! So stately, so eternal; the joy of man, the comfort of all living creatures, the glory of the earth — they are but the monuments of those poor leaves that flit faintly past us to die. Let them not pass without our understanding their last counsel and example: that we also, careless of monument by the grave, may build it in the world — monuments by which men may be taught to remember not where we died, but where we lived." — Ruskin.

It is unnecessary for the writer of the present article to add to what has already been written in admiration of our gorgeous autumn foliage. We all appreciate this sunset of brilliancy preceding the cool twilight tints of winter, and we all know that it is given only to us dwellers in the temperate zone to enjoy a display such as even the tropics cannot afford. And indeed, as Americans, we may consider ourselves peculiarly blessed in this respect; for it is a common remark of travellers, that our autumnal tints surpass any thing of the kind in Europe. It is not with such considerations, however, that this article has to deal, but rather with an account of what takes place within the leaves as their color changes, and how these changes are brought about. While there still remains much that we cannot satisfactorily explain, yet our ignorance in the matter has been greatly lessened within the past few years by the investigations of chemists and botanists; and it is our object to view, in the light of these recent additions to our knowledge, the several problems involved.

On the same principle that an artist working with a few pigments can produce a picture rich in variety of color, so it appears that all the ordinary tints of autumn leaves may be considered as due to the presence, either singly or combined, of but four different kinds of coloring-matters. The names of these substances, with their colors and modes of combination, are exhibited by the following table:

Cyanophyll. (Greenish blue.)	*Chlorophyll.* (Leaf-green.)	
Xanthophyll. (Yellow.)		Greenish bronze.
Erythrophyll. (Crimson.)		Scarlet to orange.
Phaiophyll. (Brown.)		Brownish yellow.

It will thus be seen, that, in order to understand the color-changes of autumn leaves, it is necessary for us to know something of the nature of these coloring-matters, and how they arise in the leaf.

We will first consider the green coloring-matter of the unchanged leaf, the so-called chlorophyll. This may be readily extracted, although with various associated waxy matters, by treating fresh green leaves with alcohol. If, now, such an extract, made with sixty-five per cent alcohol, is shaken with about twice its volume of benzole, and then allowed to stand for some time, there separates a benzole layer above, having a greenish-blue color, and an alcohol layer below, tinged with yellow. The yellow pigment is xanthophyll, and the bluish one cyanophyll; and thus it is shown that what is often called the chlorophyll pigment is, in fact, a mixture of two pigments, as above indicated in the table.

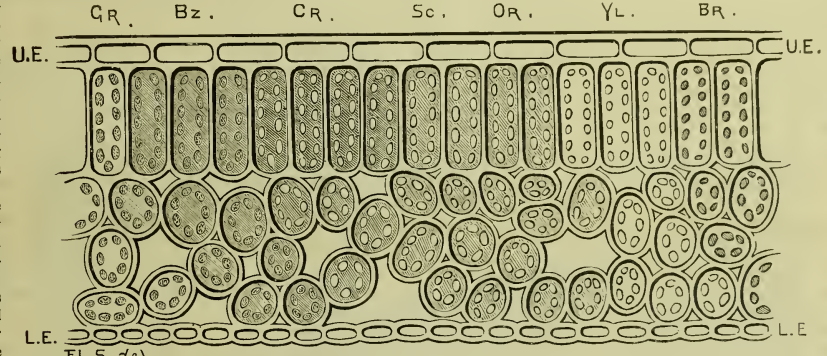
Red leaves owe their color to erythrophyll. Unlike either of the chlorophyll constituents, erythrophyll is soluble in water; so that, when bruised red

leaves are soaked in warm water, the water becomes strongly tinged with crimson. The leaves at the same time assume a decidedly yellow color: that is to say, xanthophyll is still present in a red leaf; but the cyanophyll has disappeared, and we have in its place a red pigment. This strongly suggests the conclusion that erythrophyll is produced from cyanophyll as green leaves turn red; and although we can say nothing regarding the chemistry of the change, still, as the conclusion tallies well with all we know on the subject, it may be accepted, at least provisionally, as a fact.

The transformation of cyanophyll into erythrophyll is paralleled by a change of the leaf-yellow into the leaf-brown. This conversion of xanthophyll into phaiophyll appears to result from an oxidation or decomposition of the former, and perhaps also of other remnants of various carbonaceous substances remaining in old leaves.

These chemical considerations lead the way to an understanding of what is discovered by a microscopical examination of autumn leaves. The pulpy part of an ordinary leaf is made up, as is well known, of a number of tiny compartments or cells, in which resides the gelatinous living matter or protoplasm of the leaf, together with a quantity of a watery fluid called the cell-sap. Imbedded in this living jelly are numerous green granules, which are minute masses of relatively denser protoplasm colored by the chlorophyll pigments. These are known as the chlorophyll grains. In order to best study the autumnal changes which take place in the cells, it is necessary to select leaves in various stages of turning; and where in the same leaf are exhibited different stages in different portions, a thin transverse section is to be cut, so as to include the different stages and the intermediate transitional region. On examining under the microscope a sufficiently thin slice made in this way, we have presented for our observation a series of cells, exhibiting all the stages of transition from one color to another. In passing from the green to the red condition, the first change perceptible is the appearance of erythrophyll dissolved in the cell-sap of certain cells scattered here and there among the unchanged green cells. The sap of these cells, at first tinged a rose color, deepens finally into a beautiful crimson. This intermingling of crimson cells with the green ones gives rise to the greenish-bronze color to be noticed in leaves just beginning to turn. At first the chlorophyll grains of the cells with erythrophyll are distinctly green, but as the intensity of the red in their sap increases, their color changes to yellow. The appearance of erythrophyll proceeds now rapidly in more and more of the cells, until, in the bright red leaves, nearly all of the cells are filled with crimson sap. When all the cyanophyll has been converted into erythrophyll, the red color of the latter begins to decrease in intensity. Certain cells, which presumably were the first in which the erythrophyll was formed, now have their sap become pink, and then colorless. Other cells follow, until all have become free from any trace of red pigment. What the chemical significance of this bleaching process is, has not yet been made out. The result as seen in the leaf, however, is sufficiently plain. The chlorophyll grains, first deprived of their leaf-blue, and then masked by the erythrophyll, are now able to effect the color of the leaf by the yellow of their xanthophyll, in proportion as the force of the red diminishes. It is in this way that the stages of scarlet, orange, and yellow consecutively arise. The cells of a brown leaf have their contents in a broken-down condition, indicating that a general disintegration or decomposition is going on.

Many kinds of leaves do not pass through all the changes of color which have been described, and these increase the difficulties of our problem. For example, elm-leaves turn from green to yellow. The explanation of this may be, that some bleaching action, like that before referred to, may be brought to bear on the cyanophyll before it has a chance to turn red. The majority of the leaves on a vine of Virginia creeper pass directly from crimson or scarlet to brown. Here it would seem, that, for some reason or other, decomposition had set in prematurely. When, as in some oaks, the change is abruptly from green to brown, it is possible that similar causes, accelerated in action, may be at work. Still, until more is known regarding the causes of many of the chemical changes we have been dealing with, mere surmises, however poor substitutes for explanations, are about all that can be offered.



Diagrammatic representation of a transverse section of part of an autumn leaf, highly magnified, showing epitomized the changes taking place in the cells as the leaf passes through the stages of green (Gr.), bronze (Bz.), crimson (Cr.), scarlet (Sc.), orange (Or.), yellow (Yl.), and brown (Br.). U.E. is the upper epidermis, L.E. is the lower epidermis; both transparent. The shades of pink and crimson in the cell-sap are indicated by the intensity of the oblique line-shading. The chlorophyll grains when dotted are green; when unshaded, yellow; and when cross-lined, brown.

It now remains for us to inquire, What is the significance of these color-changes? Have they not something to do with the plant's preparation for the approaching winter?

Considerable light is thrown upon this question by comparative chemical analyses of leaves before and after their fall. Such analyses show a marked decrease of nitrogen. The meaning of this is clear when it is remembered that protoplasm is *par excellence* the nitrogenous substance of the plant. At the approach of winter the precious living matter of the leaf is drawn back into the stem, where it will be protected against harmful variations of temperature. How this withdrawal of the protoplasm could take place, — that is to say, how the protoplasm could pass from cell to cell through the walls, and so back into the cells of the stem, — would have baffled botanists to explain a few years ago. The recent researches of Gardiner and others have shown us, however, that the protoplasm of adjoining cells communicates by delicate threads of its substance, which pass through exceedingly minute perforations in the wall, and thus the protoplasm of the stem and leaves forms a continuous whole. We may conceive, therefore, of this great body of the plant's protoplasm as slowly contracting, and drawing into itself the portions that have been temporarily projecting as outgrowths in the leaves. A natural result of this withdrawal of the protoplasm would be a disintegration of the organic compounds remaining; and we can now picture to our minds, at least conjecturally, the way in which the changes in the color of the leaf-pigments is effected. The chlorophyll, as soon as it is deprived of the vital influence of the protoplasm, begins to break down. The blue-green constituent turns to red, and finally disappears from view. The yellow constituent, perhaps more protected by the wax, slowly oxidizes; and finally all the organic remnants which the protoplasm has left behind in the cells, decompose.

The last act which the protoplasm performs as it retires into the stem, is to make complete the provision for the fall of the leaf. Sometimes even so far back as the summer, but usually later, there begins to be formed at the base of the leaf-stalk a plane of cork-cells. This plane, a few cells in thickness, extends from the outside inwards; and it frequently happens, that, in the late autumn, all that is needed to extend the plane completely across is the building of a few cells. When this is accomplished, the leaf is ready to fall. It should be noted here, that not only is cork a tissue which can be most readily torn, but it is, at the same time, the tissue of all others best calculated to protect a wounded surface. Whereas, before the completion of the cork-plane, the leaf could only have been torn from the stem by the exertion of force sufficient to pull away considerable of the bark and subjacent tissue, now the leaf drops at the slightest breath of wind, and there is left on the stem a smooth scar completely healed over, so that no bleeding can take place.

The case of a certain elm-tree, observed by Professor Richard Owen, is of interest in this connection. One limb of the tree was struck by lightning about the middle of the summer. All the leaves of the lightning-struck branch soon turned abruptly from green to brown. When the autumn came, the other leaves turned yellow, and fell in the normal fashion; while the brown leaves killed by the lightning still clung to the tree. Winter came, and they still remained, until, in the spring, they gradually rotted off. The explanation of this abnormal behavior of the leaves is, of course, this: The protoplasm, suddenly killed, was unable to form the severing plane of cork-cells, and the summer connections remained intact. Moreover, the mass of dead protoplasm contained in the leaves necessarily decomposed at once, giving rise to a brown color instead of a yellow.

The color-changes of autumnal leaves have often been compared to the similar changes taking place in the ripening of fruits. Undoubtedly the resemblance is in many cases very close. In an apple,

for example, we have, at the surface, cells which are at first green with chlorophyll, and which subsequently pass through stages closely parallel to the changes we have considered in autumn leaves; and we have even formed at the base of the stalk a severing cork-plane, the same as before described. But this statement of similarity must not be accepted without important qualifications. There are many fruits in which it appears that special colored granules are developed, different from any to be found in leaves. And furthermore, whereas in the case of colored fruits a distinct function may be generally ascribed to these brilliant pigments, — namely, that of attracting animals for purposes of seed dissemination, — the colors of autumn leaves cannot be said to be of any use to the plant. We understand, by the ripening of a fruit, a development toward that maturity in which its proper functions may be performed. On the other hand, when a leaf changes color in autumn, its period of usefulness has passed; it has no longer any function to subserve. Therefore to speak of these autumnal changes as a ripening of the leaf is inappropriate.

In conclusion, let us briefly summarize the history of the autumn leaf. The leaves of summer are but temporary laboratories, in which protoplasm best performs its summer work. With the end of the summer's warmth that work must cease, for the chilling temperatures that herald the winter render the exposed position of the leaf protoplasm dangerous to its life. In obedience, therefore, to these external influences, the plant's protoplasm contracts, and draws into proper winter quarters the living matters of the leaves. Certain substances, in a sense excreted by the protoplasm as it retires, change and decompose, giving us the gorgeous tints of autumn. With a whole season's use, the non-living part of the leaves has become too much worn out to be of future value to the plant: it were better, therefore, that these encumbering appendages be cast away. Preparations for this final act are nearly completed by the last of the season; so that all that remains for the protoplasm to do, as it leaves its summer habitation, is, as it were, to close the door behind it. This done, the autumn leaf, emptied of its precious contents, drops from the parent stem, leaving a scar that was made and healed before it fell.

THE LAWS OF HABIT.

From a brilliant essay by Professor William James upon the above subject, in the *Popular Science Monthly* for February, we make the following extracts: —

"'Habit a second nature! Habit is ten times nature,' the Duke of Wellington is said to have exclaimed; and the degree to which this is true no one can probably appreciate as well as one who is a veteran soldier himself. The daily drill and the years of discipline end by fashioning a man completely over again, as to most of the possibilities of his conduct. There is a story, which is credible enough, though it may not be true, of a practical joker, who, seeing a discharged veteran carrying home his dinner, suddenly called out "Attention!" whereupon the man instantly brought his hands down, and lost his mutton and potatoes in the gutter. The drill had been thorough, and its effects had become embodied in the man's nervous structure.

"Riderless cavalry-horses, at many a battle, have been seen to come together, and go through their customary evolutions at the sound of the bugle-call. Most trained domestic animals — dogs, and oxen, and omnibus and car horses — seem to be machines almost pure and simple; undoubtingly, unhesitatingly doing from minute to minute the duties they have been taught, and giving no sign that the possibility of an alternative ever suggests itself to their mind. Men grown old in prison have asked to be re-admitted after being once set free. In a railroad accident to a travelling menagerie in the United States some time in 1884, a tiger, whose cage had broken open, is said to have emerged, but presently crept back again, as if too much bewildered by his new responsibilities, so that he was without difficulty secured.

"Habit is thus the enormous fly-wheel of society, its most precious conservative agent. It alone is what keeps us all within the bounds of ordinance, and saves the children of fortune from the envious uprisings of the poor. It alone prevents the hardest and most repulsive walks of life from being deserted by those brought up to tread therein. It keeps the fisherman and the deck-hand at sea through the winter; it holds the miner in his darkness, and nails the countryman to his log-cabin and his lonely farm through all the months of snow; it protects us from invasion by the natives of the desert and the frozen zone. It dooms us all to fight out the battle of life upon the lines of our nurture or our early choice, and to make the best of a pursuit that disagrees, because there is no other for which we are fitted, and it is too late to begin again. It keeps different social strata from mixing. Already at the age of twenty-five you see the professional mannerism settling down on the young commercial traveller, on the young doctor, on the young minister, on the young counsellor-at-law. You see the little lines of cleavage running through the character, — the tricks of thought; the prejudices; the ways of the 'shop,' in a word, — from which the man can by and by no more escape than his coat-sleeve can suddenly fall into a new set of folds. On the whole, it is best he should not escape. It is well for the world that in most of us, by the age of thirty, the character has set like plaster, and will never soften again.

"The great thing, then, in all education, is to *make automatic and habitual, as early as possible, as many useful actions as we can*, and to guard against the growing into ways that are likely to be disadvantageous to us, as we should guard against the plague. The more of the details of our daily life we can hand over to the infallible and effortless custody of automatism, the more our higher powers of mind will be set free for their own proper work. There is no more miserable human being than one in whom nothing is habitual but indecision, and for whom the lighting of every cigar, the drinking of every cup, the time of rising and going to bed every day, and the beginning of every bit of work, are subjects of express volitional deliberation. Full half the time of such a man goes to the deciding, or regretting, of matters which ought to have been so thoroughly ingrained in him as practically not to exist for his consciousness at all. If there be such daily duties not yet ingrained in any one of my readers, let him begin this very day to set the matter right.

"In Professor Bain's chapter on 'The Moral Habits,' there are some admirable practical remarks laid down. Two great maxims emerge from his treatment. The first is, that in the acquisition of a new habit, or the leaving off of an old one, we must take care to *launch ourselves with as strong and decided an initiative as possible*. Accumulate all the possible circumstances which shall re-enforce the right motives; put yourself assiduously in conditions that encourage the new way; make engagements incompatible with the old; take a public pledge, if the case allows; in short, envelop your resolution with every aid you know. This will give your new beginning such a momentum that the temptation to break down will not occur as soon as it otherwise might, and every day during which a breakdown is postponed adds to the chances of its not occurring at all.

"The second maxim is: *Never suffer an exception to occur till the new habit is securely rooted in your life*. Each lapse is like the letting fall of a ball of string which one is carefully winding up; a single slip undoes more than a great many turns will wind again. *Continuity* of training is the great means of making the nervous system act infallibly right. As Professor Bain says, 'The peculiarity of the moral habits, contra-distinguishing them from the intellectual acquisitions, is the presence of two hostile powers, one to be gradually raised into the ascendant over the other. It is necessary, above all things, in such a situation, never to lose a battle. Every gain on the wrong side undoes the effect of many conquests on the right. The essential precaution, therefore, is so to regulate the two opposing powers, that the one may have a series of uninterrupted successes, until repetition has fortified it to such a degree as to enable it to cope with the opposition under any circumstances. This is the theoretically best career of mental progress."

SCIENTIFIC BREVITIES.

Ancient Minerals and Metals. — At a recent meeting of the French Académie des Inscriptions, M. Berthelot read a paper on "Certain Metals and Minerals used in Ancient Assyria and Chaldea." By the help of chemical analysis he had investigated the substance of several objects from Assyria and Chaldæa, with interesting results. A sacred tablet from Khorsabad was found to be entirely composed of pure carbonate of soda, — a rare substance, even at the present day. Among the objects brought back by Mr. Sarzec from his excavations at Tello are two remarkable examples of the employment of metals without alloy. One is a vase of pure antimony; the other is a statuette of copper, without any trace of tin.

Phosphorescence of Alumina. — In a memoir recently presented by M. de Boisbaudran to the Paris Academy, it is asserted that very pure precipitated alumina, when excited by electric discharges in a vacuum, does not give a red light, which, however, can be made to appear by the addition of a ten-thousandth of oxide of chrome. The author of that memoir deduces from his observations that the characteristic red light is not derived from alumina, but is due to the presence of chrome. M. Becquerel, on repeating the experiment with some of the very same material, obtained an opposite result, in conformity with his former observations. Some fragments of this supposed pure alumina were fixed on a slip of mica with a little gum, placed in the phosphoroscope, and excited by means of the electric arc. They gave an emission of red light, but very feeble, and less intense than the light emitted by alumina containing chromium oxide, and submitted to the same treatment. But if this pure alumina is ignited for fifteen minutes in a porcelain crucible placed in a gas-furnace fed with compressed air, it becomes as brilliantly luminous and red in the phosphoroscope as alumina containing chrome.

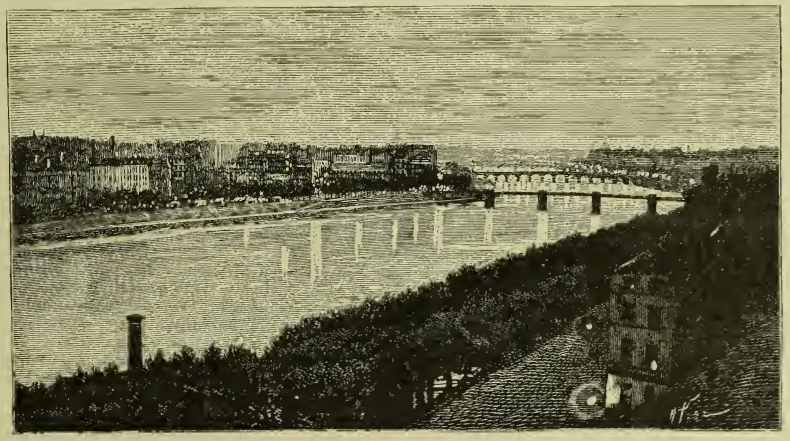
A Novel Substitute for Telegraph Wire. — The telegraph line built by the French in Tonquin having recently failed to work, it was found, upon investigation, that the chief of one of the native villages had appropriated a quantity of the wire to his own use, and replaced it with a cord of vegetable fibre. He was very much surprised when informed of the damage he had done, and had no idea but that he had made "a fair exchange, and no robbery."

Practical Chemistry and the Arts.

NOCTURNAL PHOTOGRAPHY.

Until the invention of the dry-plate process, all photographic operations required the greatest amount of light attainable; but the superior sensitiveness of these plates, as now made, render the degree of illumination of the object to be photographed of little consequence, provided a sufficiently long time for exposure can be obtained.

A recent number of *La Nature* gives several views of landscapes taken at night by the light of the full moon. We reproduce one of the best, a view of the city of Lyons, with the River Rhone and its bridges, which is the work of an amateur of that city, M. Dor. The clearness of the photograph is wonderful; and, except for the lights in the buildings and on the bridges, and their reflection in the water, it could hardly be distinguished from one taken in the day-time. The time of exposure of the plate was one hour.



Another photographer has obtained very excellent views of his library at night, by ordinary gaslight. In this case, the time of exposure was only thirty minutes; and, when it is remembered that the old-fashioned wet collodion plates were almost entirely unaffected by the light from such a source, the sensitiveness of the modern plates will be appreciated.

Still another experimenter has attempted to obtain a photograph of fireworks while burning; and the results obtained are surprisingly good. The streams of fire thrown into the air are reproduced with great distinctness, and the parabolic form of their path is very evident. In all these experiments no diaphragm was used in the camera, and the clearness of the views seems to be unaffected by the omission.

The art of photography is at present advancing with rapid strides, which is due in no small measure to the large number of amateurs, who can undertake experiments which professional photographers frequently have neither the time nor means to carry on. New and interesting developments are being made known every day, and it is difficult to say when or where the end will be reached.

ICE-PALACES.

The ice-palaces of our day, and especially the stately one erected this season at St. Paul, far surpass any thing of the kind ever before attempted in the world. The Russian structure of 1739, which has been so long famous in prose and poetry, was a small and poor affair compared with this recent triumph of Yankee art in making "marble of the glassy wave" for a magnificent edifice. We read that the Russian building was only fifty feet long, sixteen wide, and twenty high. Before it were stationed two ice mortars and six ice cannon, with carriages and wheels also of ice. The cannon were six-pounders, but only a quarter of a pound of powder was used in loading them; and the balls were of hemp, though on one occasion iron balls were used. The ice was only four inches thick, but it withstood the explosion. The "palace" had but two rooms; and the furniture was of ice, even the bed being covered with *sheets* of the same material, though it is not to be supposed that anybody slept in it, unless perchance clad in a sealskin night-shirt. It would have astonished the autocratic master of this glacial shanty, could he have seen what advances in arctic architecture have been made in this democratic land and day.

NICKEL AS A MATERIAL FOR DISHES AND CRUCIBLES.

It is well known that pure nickel is one of the toughest of all the metals, and that it fuses only at very high temperatures. It has a very fine grain, takes a high polish, and is very compact and unalterable

These qualities have led to its being employed for crucibles and evaporating-dishes. I have recently had some of these vessels in my laboratory.

A small crucible of pure nickel weighed 17.6025 grams. It was then ignited strongly by means of a large Bunsen burner, and when cold was reweighed. Not the slightest alteration in weight could be detected.

A larger crucible, weighing 39.666 grams, was also experimented upon, and exhibited a like constancy of weight on ignition.

For many purposes, crucibles of pure nickel are quite as serviceable as platinum crucibles; and they are much cheaper, costing only about one-tenth as much as platinum.

They stand the action of alkalies remarkably well: there was no alteration in the weight of the crucible after caustic potash had been fused in it.

Hydrochloric acid in the cold, whether dilute or concentrated, may be used to clean out these crucibles, and no alteration in weight is the result.

Cold oil of vitriol is likewise without action; but concentrated nitric acid attacks them, causing rapid loss of weight.

My experience leads me especially to recommend nickel dishes as suitable vessels for taking water residues and milk-solids; and, indeed, for these purposes I do not think that nickel is at all inferior to platinum. — J. A. Wanklyn, *in Chemical News.*

A NEW COAL PRODUCT FOR TANNING LEATHER.

The Frankfort-on-the-Main *Ledermarkt* of Oct. 16, 1886, contains an account of a patent process of tanning leather, by a new substance called pyrofuxin, found in mineral coal by Professor Paulus F. Reinsch of Erlangen.

After the contact of pyrofuxin with the skin, it rapidly unites with the tissues; so that, after a long soaking in water, the leather is not decomposed, and the pyrofuxin is not extracted. The rapidity of its action is, when compared with that of alum or bark tanning, as one to fourteen for alum, and one to twenty-eight for bark; that is, it takes fourteen times as long to tan with alum as with pyrofuxin, and twenty-eight times as long to tan with bark as with pyrofuxin. The structure of the corium of pyrofuxin leather is finer in fibre, more closely interwoven, and with a sharper delineation of the fibres, than in alum or bark leather. The epidermis is harder and more elastic. It is also stronger. Comparative experiments, made by weighing equal-sized bands of leather, taken from like parts of sheepskins alike in the raw state, yielded the following results: Pyrofuxin sheepskin leather bore from two to three and a half times more weight than bark-tanned sheepskin, and from four to five times more weight than the alum-tanned sheepskin. The cost of tanning-material is lower by twenty-five per cent. Dry pyrofuxin is a fine, non-triturable substance, without smell or taste, insoluble in water, non-poisonous, and looks like catechu; is soluble in caustic alkalies.

All mineral coals do not yield pyrofuxin. It is found most abundantly in the leaf or paper coal of Central Russia, and the bituminous coal of Central Europe. This is an important discovery, for any process that increases the durability of leather, and diminishes the cost and time of production, is economical, and increases the demand, and makes the inventor a benefactor. C.

TAKING TRAIN SPEEDS IN PRUSSIA.

For the regulation and checking of train speeds, the Prussiau authorities, after trying a number of speed-recorders without full satisfaction, have con-

cluded to introduce an "electric contact" apparatus, which has now been in use for nearly ten years, and on the Elberfeld system of Prussian roads is used on a hundred and forty-four miles of track. It consists of electric keys, with strong springs placed outside the rails at regular intervals, the most approved distance being one kilometer. The keys are depressed by each wheel; and the current, thus sent through a wire to the next telegraph office, causes a strip of paper moved by clockwork to be dotted for each depression. The paper moves at the rate of four centimeters a minute; and the distance apart at which the first dots of each two successive series appear, shows the rate of speed at which the train is moving. When the operator at a station gets word from the next one of a train's departure, he sets the paper in motion, and lets it run until the train reaches his station. The strip of paper, which has run off in the meantime, is marked by cross-strokes at its end; and the date, the number of the train and engine, and the name of the engine-runner, are written upon it. The operator soon becomes accustomed to recognizing the speed from the appearance of the spaces, and he is charged with the duty of noting any obvious excess of the speed allowed. At the end of the day the strip is removed, and sent to headquarters as a part of the office report; the work of inspection being made easy by the notes on the strip. The runner is placed in position to check up his own speed, as the contact-keys are visible by day and recognizable by their click at night. This method is reported as highly satisfactory in checking the tendency of runners to save coal by "loafing" up hill, and running down at full speed. The apparatus, being arranged to show the speed for any desirable distance, or at any point, shows whether express-trains slow properly in passing stations, and it also indicates very closely the occurrence of a breakdown and its position. — *English Mechanic.*

[Special correspondence of the *Science News.*]

PARIS LETTER.

[Owing to unforeseen delays, this letter was received too late to be placed in its proper department. The writer is well known abroad in scientific circles, and will in future contribute to our columns regularly, furnishing the latest European scientific news. — Eds.]

A good deal of a sensation has been made during this month, in scientific circles, by Professor Peter of the Medical School, who, in three speeches delivered before the Academy of Medicine, has been making a vigorous attack against Pasteur's work in the treatment of rabies. It must be said, however, that he has not succeeded in his object, owing to many errors in his statements, and to his absence of scientific method. M. Peter is a good physician, but he is no scientist, and has had nothing to do with experimentation. Pasteur's ideas and theories are too new, too novel, to him; and they so entirely overthrow many ancient and time-honored opinions concerning general pathology, that many old physicians cannot make up their mind to follow the new theories. Such is the case with Professor Peter. Some days ago he delivered a clinical lecture, beginning in this way: "I have recently observed a case within my wards, showing that vaccination, when practised after the beginning of small-pox, does not prevent the development of the latter disease." Well, nobody ever said it could interfere in a useful manner. It has even been prescribed not to practise vaccination during small-pox epidemics. And he continues, saying, that, by analogy, it must not be expected that preventive anti-rabic inoculation can be of any use when made on a person already bitten by a rabid animal. But, as the French proverb goes, comparisons are no reasons, especially in the present case; and although Pasteur's discoveries are thoroughly novel, and do not remind of any analogous fact, they are supported by something much better and more useful than comparisons by facts.

Professor Peter's whole attack went to say that preventive inoculations, when practised by the ordinary method, are useless but harmless, but that the interim-inoculations method is not only useless but harmful; that it has been the *cause* of death of many persons who might perhaps have otherwise survived; that the treatment *killed* them. He totally ignores the bites inflicted upon these unfortunate victims, and takes no account of them at all. This is not logical. Nobody, in case death would have ended the life of these persons before any inoculations were made, would have hesitated a single moment to believe that rabies was the cause of death; why, then, are we to overlook entirely this cause of death when inoculations have been made? In such cases, death only shows that the method is not an infallible one, as Pasteur himself has written and said on many occasions. On the other hand, favorable facts are by no means scarce, and they show how useful the method must be. That the death-rate has been very much lowered by the anti-rabic inoculations, is a fact which cannot be disputed. In short, Professor Peter has done all he can to injure Pasteur's method; and the result is, he has done no harm save to himself, showing how inaccurate he is when adducing facts, and how little he is endowed with a scientific method of thinking.

The assistants of Pasteur are starting at present a new periodical, a monthly paper, devoted to all questions concerned with micro-biology, which will contain original contributions and reviews. It is edited by Professor Duclaun, with the aid of the prominent micro-biologists of Paris. The first number is to be issued by the end of January. It will contain also monthly statistics concerning anti-rabic inoculations.

A Belgian botanist, M. L. Errera, has recently read, before the Royal Botanical Society of Belgium, an interesting paper concerning the way in which plants protect themselves against animals. This question has already been investigated by many scientists, but M. Errera is able to add valuable information to the facts already known. Many plants are protected by *biological characters.* Some live in remote and inaccessible places, — on rocks, for instance, or in the water. Others huddle together so very close, that it is impossible to animals to pass through or underneath. Some rely upon the protection afforded by other plants. Some assume the appearance of dangerous plants, and are protected by their similitude; such is the case, for instance, of *Lamium album*, which resembles *Urtica dioica.* A second group of plants rely on *anatomical* characters. Such is the case of many which are endowed with thorns, prickly leaves, or other hard, cutting, or acute organs; such cases are frequent, and examples are familiar to everybody. Finally, some rely on chemical characters, and are possessed with alkaloids, bitter or acid principles, or with essential oils whose taste or smell is disagreeable. It seems, from M. Errera's experiments and observations, that this last sort of protection, that afforded by chemical characters, is the most reliable and useful to plants, as it is this last-named group which is least subject to destruction on the part of animals. As he remarks, it is a singular fact that all our artificial methods to protect plants are exactly the same these rely upon. We surround our gardens with walls, we allow water to surround our hot-houses to keep snails and similar animals out of them, we put camphor and other strong-smelling substances in our herbariums to keep insects away, just as plants have done themselves, long before man appeared on our globe.

Bicycles and tricycles are becoming implements of war in Europe. The fact that, with the aid of these instruments, a man may make much greater and faster progress with less fatigue, has attracted the attention of many army officials, and experiments are being made on the services they might render in war. In Italy they have been, since some ten years, used for the postal service, and with so much success that each regiment is now provided with three of them. Experiments in Holland and Austria are also giving good results. In Germany bicycles are going to be put in use, the experiments having been quite satisfying. France is now following the example. The army officials in charge of the experiments seem to prefer the tricycle, although the speed is less, because this instrument allows a certain amount of luggage; but they are also very favorable to the *bicyclette*, which is a sort of compound of bi- and tricycles. The three instruments are going to be simultaneously experimented upon in the three schools for infantry of Saint-Cyr, Joinville, and Saint-Maineut; and, after the experiments, one of them will be preferred to the others.

Admiral Aube's new gunboat, of which much has been expected, seems to be a failure. It seems that it is built on unsound principles, and that it will not be able to stand rough water. It rolls easily, and will be overturned if it has to resist even a moderate squall. If the water is not quiet, it dances and rolls in such a manner as to prevent all use of the gun, since it is impossible to point it with any chances of fetching what it wants: it will fetch any thing except the thing aimed at, which is of questionable usefulness.

Experiments are going on, with a new powder, the *milinite.* It is ten times stronger than ordinary gunpowder, and has given such good results that two hundred thousand obres have been ordered. They are to be experimented upon in the storming of two small batteries built up for the purpose, in stone and earth.

A statue has been recently erected to the memory of Denis Papin, who built the first steamboat. Papin was born in 1647. He studied medicine first, but had such a loving for physics, that he gave up medical practice, and gave the whole of his time to mechanical pursuits. In 1704 he built his first steamboat; but, owing to the lack of money, he was able to try his new invention only in 1707, on the River Weser. But the boatmen destroyed his boat, and no more was thought of his marvellous invention at the time. It has luckily survived, but the unfortunate inventor died quite ruined and discouraged by adversity, without even feeling that a fair trial would be given to him, and that he would be an instrument to general welfare and comfort. How many inventors have died under these sad conditions! H.

Paris, *Jan.* 30, 1887.

Reducing Silver Ore in Mexico. — A recent visitor to a Mexican silver-mine relates that he was shown a mass of mercury, weighing two pounds, taken from the stomach of a horse that had worked in the *patio.* He says: "In this primitive Mexican process, which seems to be well suited to the wants of the country, the ground ore, or silver mud, is mixed with salt, mercury, etc. The horses that tread this mud for weeks, in order to mix the chemicals, attracted by the salt, lick up the mud, and take in the poisonous quicksilver. This, accumulating in the system, finally kills them. I was informed that the bones of these animals are ground up, in order to obtain the mercury in them."

Home, Farm, and Garden.

THE EVAPORATION OF WATER IN FURNACES.

It is an almost universal practice to have a vessel of water attached to furnaces for the purpose of moistening the air of rooms heated by them. The common notion, that the aqueous vapor purifies the air in any way, is, of course, absurd; but the possibility that it may render the air heated by the furnace more healthful and easier to breathe, may be worthy of consideration.

The following calculation, based upon conditions actually existing in a residence, may serve to show the fallacy of this belief: —

In the house referred to, eight rooms, with an aggregate capacity of 16,500 cubic feet, are heated by a hot-air furnace, which evaporates one pailful of water, weighing eighteen pounds, daily. At a temperature of 70°, assuming the air in the house to be only half saturated with moisture, the total amount of water contained in it will be about twelve pounds.

This would apparently show that the eighteen pounds of water evaporated would have a marked effect upon the hygrometric state of the air, but it must be remembered that a constant current of fresh air is passing through the furnace and into the house. It would be a low estimate to assume that the air is completely changed every hour, and therefore only an additional three-quarters of a pound of aqueous vapor would be present in the air at any one time, which would only increase the percentage of moisture from 50 to 53.1 per cent, — an amount too small to be of any consequence.

An actual test, made on two successive days with the dry and wet bulb hygrometer, showed that the percentage of moisture in the air was the same whether water was evaporated in the furnace or not.

In a close, unventilated room, the impure air may be easier tolerated by the lungs when saturated with moisture; but, with the constant supply of fresh out-of-door air with which every apartment should be supplied, any artificial addition of aqueous vapor is both unnecessary and useless; and only in very exceptional cases is it likely to produce any beneficial effect upon the health of the persons breathing it.

THE MYSTERIES OF PLANT-GROWTH.

PART I.

The preliminary inquiries which naturally arose in the minds of our first great agricultural chemists were those having relation to how plants grow, whence they obtain their food, of what elements that food is composed, how it is conveyed to them, and how absorbed into their organisms.

Before these questions could be answered, it was necessary to call in the aid of botany, to find out the history of each plant, to gaze at it through the microscope, to take it into the laboratory and determine its chemical composition, and, from the result obtained by all these experiments, to gather, by deduction, how it lived and had its being.

For such scientists as Liebig and Boussingault, only a very short time was necessary to arrive at satisfactory conclusions, and to demonstrate that the manner of life in plants was very similar, in all respects, to that of man: that they require certain foods in stated proportions, which pass through the process of digestion; that they must breathe a certain atmosphere, and are subject to the influence of heat and cold, drought and moisture, light and darkness.

The tissues of their bodies, like those of man, were found to be composed of carbon, hydrogen, and oxygen, and to contain, besides nitrogenous principles, certain minerals, such as lime, potash, sulphur, magnesia, iron, and phosphoric acid. From this it was argued, — and very justly so, — that if it is necessary for man to constantly absorb a sufficiency of these same elements to keep up his normal heat, and repair his waste of tissue, it must be no less essential for plants to acquire similar food, to repair similar losses arising from the same cause.

Pure atmospheric air is a mixture of nitrogen and oxygen, with a small proportion of aqueous vapor, and about four-ten-thousandths of carbonic acid; while water is formed by the combination of two parts of hydrogen and one part of oxygen. It follows, therefore, that the principal organic elements of plant-food exist in the atmosphere, as air, water, and charcoal, and must be chiefly absorbed from without by the leaves; while the whole of the mineral bodies are found in the soil, and are taken up from within by the roots.

The process by which the first manifestation of plant-life is produced, is called germination; and nothing could possibly be of greater interest than the consideration, in all its known aspects, of this remarkable phenomenon.

When ripe seed is taken from the parent plant, it gradually dries, and, when dry, may be kept for an indefinite period without undergoing any change. If, however, it be placed under favorable circumstances of temperature, moisture, and air, it soon begins to swell, to burst its membranes, and to expand its germ. If we choose, for the purpose of illustration, such seeds of the dicotyledonous order, as the pea, the bean, and the lupine, and remove the common membrane with which they are covered, we shall lay bare two small bodies, one termed the radicle, destined to form the root, and the other called the plumula, from which are developed the stem and the leaves.

As germination can take place equally well in a sponge, in cotton-wool, or in sand, I need not devote, at this juncture, any consideration to the soil necessary to the plant, but content myself with noticing the effect produced on the seed by the moisture, the air, and the temperature, and the various metamorphoses effected in the composition of its proximate principles.

The part which develops itself with the greatest rapidity is the root, the materials for its growth being derived from the cotyledons, which, when they shoot out their fibres, or rootlets, in a downward direction, absorb nourishment from the soil, and so are enabled to develop the plumula, causing it to rise upwards, and gradually expand itself into the stem and leaves.

The presence of air is absolutely necessary for this growth; numerous and conclusive experiments having shown that if it be absent, although all other conditions of heat and moisture are fulfilled, no vegetation will take place. Hence we frequently find, that, when seeds are buried very deep in the earth, or in a stiff clay, they remain inert; and it is not until, by turning up the soil, we admit a sufficiency of oxygenated air, that they begin to shoot forth.

When seeds are germinated in confined atmospheres, a large quantity of carbonic acid is evolved, and part of the starch of the cotyledons is transformed into sugar and gum; hence most seeds become extremely sweet during the process of germination, as, to choose a familar example, we all know to be the case in the conversion of barley into malt.

Many authors maintain that light is injurious or unfavorable to the growth of a seed; but my own experiments in no wise bear out this view, for I have frequently sown seeds in glass vases placed side by side, the ones opaque, the others perfectly transparent, and in every case germination has taken place simultaneously. The only notable exceptions to this rule have been when the vases were directly exposed to the solar rays, and I have concluded from this that the obnoxious influence of the latter is specially due to their desiccating power.

Arguing from my own experience, the best possible conditions for successful germination are attained by placing the seed under the surface of a soil warmed by the sun and moistened by occasional showers. It should, however, be excluded from the direct action of the sun's rays while within access of the air.

Despite the fact that seeds will not germinate at a very low temperature, that which is necessary varies considerably with the different kinds; thus, for winter wheat, barley, and rye, the absolute minimum is 45° F.; any thing lower being not only inimical to, but positively destructive of, their germinative faculties. On the other hand, there is a point above which too high a temperature becomes fatal: but here, again, every thing depends upon the variety of the seeds; those of tropical countries requiring from 112° to 120° F., whereas in colder climes 100° F. will effectually prevent the growth of beets, turnips, and similar vegetables.

It has been demonstrated that the mean temperature at which the growth of seeds is most favorable under the different conditions of drought and moisture, is as follows: —

For their germination in water, 122° F.
" " " " steam, 145° F.
" " " " dry air, 169° F.

This portion of the question is, however, still shrouded in a certain amount of uncertainty, as I have shown by my owu experiments upon the potato, which, when planted in appropriately moist sand, in a glass chamber, where the mean temperature was kept uniformly at 60° F., germinated with extreme difficulty during the autumn and winter, but grew with great rapidity in the spring.

When the young plant is perfected, the cotyledons are either converted into leaves, or rot away; and the process of nutrition is thenceforth carried on by the roots, which derive their nourishment from the soil *through the instrumentality of their small and extreme fibres.* I underline this latter fact, because, when these small rootlets are injured and torn, as they sometimes are by careless transplantation, the plant or tree generally dies.

The substances absorbed are chiefly saline and organic, held in solution by water; and these become the sap of the plant. This sap is propelled upwards, in the vessels of the stem or of the outer layer of wood, into the leaves, where, exposed to the agency of air and light, it transpires moisture, and sometimes evolves carbonic acid.

In some recently published papers I have already endeavored to show that the leaves of plants generally absorb moisture, and that, when this is the case, they decompose the carbonic acid under the influence of light, retaining the carbon, and giving off oxygen. The sap thus becomes modified in its composition, and the characteristic *proximate* principles of the vegetable are formed. These proxi-

mate principles return in appropriate vessels from the leaves to the inner bark, where is consequently to be found the accumulation of the products peculiar to the plant, and where, in the case of trees, it is enabled to annually form a new layer of wood.

It is because of this that the transverse sections of the wood exhibit as many zones as the tree is years old; and, although we ignore the causes of this circulation of the sap, it is nevertheless proved to follow the course I have stated, by the fact that all gardeners resort to *ringing*. This operation has for its object to make barren branches bear flowers and fruit; and it consists in cutting out and removing a circular ring of bark, so as to prevent the return of the sap by the descending vessels.

The vessels thus cut, at first ooze copiously; but the wound ultimately heals, the juices are accumulated in the parts above the extirpated ring, and, producing tumefaction in the limb, often induce a crop of flowers or fruit, or cause them to appear earlier than on the uncut branches.

If a tree be so wounded as to cut into the central portions of the wood or the outer layer of new wood, the flow of ascending sap is then seen to take place upon the lower section, where are situated the vessels that carry it up to the leaves; and the flow of descending sap is principally confined to the upper section of the inner bark, from which, after a time, new bark is produced, and the parts again become united.

Numerous scientists have endeavored to determine the part played by each of the various agents necessary to the production of the phenomena of germination, particularly with reference to that of oxygen. They have shown, by frequent eudiometric analysis, that, in a limited atmosphere, a portion of the carbon contained in the seed is transformed by the oxygen, and driven off as carbonic-acid gas: they have also observed the same effects in the germination which takes place under water; the influence of the oxygen in this latter case, although less apparent, being nevertheless indispensable, since seeds placed under water from which the air has been expelled, and is kept out, do not germinate at all.

From my own series of long and careful experiments, I have concluded, that, to accomplish its evolution, the embryo must be surrounded by air containing no less than one-eighth of its volume of oxygen, and that, when this proportion is not attained, germination may indeed sometimes commence, but will never be able to continue.

The most favorable atmosphere would seem to be that composed of one-third of oxygen and two-thirds of nitrogen, the presence of more than this quantity of oxygen having been found to so greatly accelerate the germination as to weaken the plant by almost entirely depriving it of its carbon.

According to Humboldt, germination is in some cases greatly assisted by the presence of chlorine; and he relates, that by dipping certain seeds, previous to their being sown, into water impregnated with this gas, he caused them to grow in just one-sixth of the time ordinarily required.

He also says, that some old seeds which could not be made to germinate under any other circumstances, manifested all the normal conditions of fresh seed, after he had macerated them for twenty-four hours in chlorine water.

Although several scientists have availed themselves of it to restore life to seed which had become apparently inert, this curious fact has not hitherto received much attention, nor have I personally devoted any time to its investigation. Theoretically, however, I presume that the chlorine, in decomposing the water to combine with the hydrogen, sets free the oxygen, which, attacking the carbon contained in the seed, with the increased violence resulting from its rapid dissociation, acts with more energy than the ordinary oxygen of the atmosphere, and is therefore able to give the required impetus to the commencement of oxidation.

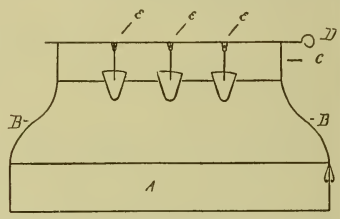
There is all the more semblance of reason in this hypothesis, when we remember that there are many examples of similar reactions, which, once commenced under the influence of some energetic agent, have been able to continue under ordinary conditions.

Francis Wyatt, Ph.D.

New York, *Jan.* 8, 1887.

A COOKING DEVICE.

The universal attention now given by the medical profession to the administering of food, would seem to render the present a proper time to bring forward ideas as to the mode of cooking the same, especially in the much-neglected preservation or production of flavor. While we may not wish a return to the creaking "roasting-jack," or may be unable to support the small "help" and long-handled basting-ladle, with open fire instead of oven, yet any one who can remember the ancient flavors must long for the results obtained by them. The work of never so good an oven cannot be deemed equal to the old method of roasting, especially for such articles (poultry and game) as require constant basting or application of gravy to produce flavor and juiciness. This cannot be done in the oven, the loss of heat and time from the constant opening preventing. The devices offered to housekeepers, called "patent self-basting pans," are all, so far as I have seen, made on the same plan, and consist of two pans hinged so as to shut closely, and confine the steam of the food and gravy; not basters at all, but steamers, and in no wise better than a good tight oven.



In my leisure hours I have given some study to a device that would do the basting in the oven without frequent opening; that should be simple in construction; above all, easily kept clean; and that would make some approach to cooking that would have the old-time flavor and juiciness.

Having produced some highly scientific machines that looked well, but did not work, I have at last, thanks to a patient tinsmith of this city, obtained something that will "cook any man's goose."

I offer it to your readers in hopes some one may give a little time to the matter, and maybe improve upon it.

Description of baster: *A* is a common iron pan. *C* is a smaller pan, an inch and a half deep, three inches wide; length not important, but shorter than lower pan. *B*, *B*, are two hoop-iron legs that are split on lower end, to spring over and grasp top of lower pan; these are riveted to small or upper pan, *C*. In bottom of pan *C* three or more holes five-sixteenths inch diameter are reamed out; into these holes drop three conical-shaped iron drops, *E*, *E*, *E*, that are hooked to a wire, *D*, running in two grooves on the ends of the pan *C*. It will be seen that tapping the end of the wire *D* moves it horizontally, and cants the drops *E* in the hole, allowing any fluid in the pan *C* to pass through the hole and down the drop, to fall from the point into the pan below.

In use, the pans and wire are arranged as described; a thin gravy is put into the upper pan; and, when in the oven, the end of the wire is tapped until the gravy drops from above to the food in the pan beneath.

This machine will run half an hour, and can be easily and cheaply made by any good tinsmith.

The size of the liquid drop is varied by the amount of *cant* given to the drops, or, better term, poppets.

Edw'd P. Roche, M.D.

Bath, Me., *January*, 1887.

GLEANINGS.

Division of Land in Germany. — In Ger, many the extent of land devoted to agriculture amounts to 78,405,000 acres; apportioned into holdings of 2½ acres and less, 1,950,000 acres; of 2½ to 25 acres, 20,225,000; of 25 to 250 acres, 37,000,000; of 250 acres and more, 19,000,000; comprising meadow-land, 14,000,000; cereal, vineyard, and gardening land, 64,000,000; cereals and vegetables, 47,000,000; fodder, 6,000,000; pastures, 8,100,000; gardening, 1,030,000; vintage, 335,000; rape, 330,000; flax, 270,000; hemp, 37,000; hops, 112,000; sugar-beet, 837,000; and chiccory, 25,000 acres.

Charcoal for Pigs. — A correspondent of the *Indiana Farmer* recommends giving pigs burned cobs, extinguishing them when fully charred and before they are reduced to ashes. This is not a new idea. Feeding charcoal to pigs is healthful and should be practised by all pork-raisers. As a general rule, farmers who burn wood for fuel will find enough coal among the ashes to serve the purpose, and their frequent use by putting with the feed should be practised. It is inexpensive, and occasions but little trouble in the use.

Worms and Turf. — "When we behold a wide, turf-covered expanse, we should remember," Mr. Darwin concludes, "that its smoothness, on which so much of its beauty depends, is mainly due to all the inequalities having been slowly levelled by worms. It is a marvellous reflection, that the whole of the superficial mould over any such expanse has passed, and will again pass, every few years, through the bodies of worms. The plough is one of the most ancient and most valuable of man's inventions; but long before he existed, the land was, in fact, regularly ploughed, and still continues to be thus ploughed, by earth-worms. It may be doubted whether there are many other animals which have played so important a part in the history of the world as have these lowly organized creatures."

The Wool Clip of 1886, instead of being twenty per cent less than that of 1885, as has been generally thought, is only seven million pounds, or barely two per cent, behind, according to Mr. Lynch, one of the highest "authorities."

Harness-Blacking. — Stearine, 3½ ounces; yellow beeswax, 10 ounces; lard, 1½ ounces; soft soap, 3½ ounces; dry powdered sugar, 10 ounces; turpentine, 9 fluid ounces; ivory black, 4 ounces; indigo or fine powdered blue, 1½ ounces. Melt the first two ingredients together. In another vessel mix the soap, sugar, and then the lard thoroughly, with the aid of a gentle heat; adding a few drops of water, if necessary, from time to time, to render the mixture smooth. Pour into a hot mortar, and work in the coloring-matters, transfer to the pot containing the melted wax, etc., stir well, add the turpentine, heat slightly, mix the whole, and pour into jars or bottles for use.

The Popular Science News.

BOSTON, MARCH 1, 1887.

JAMES R. NICHOLS, M.D.
WILLIAM J. ROLFE, A.M. } . . . . . *Editors.*
AUSTIN P. NICHOLS, S.B.

Although the season of swelling buds and opening blossoms is nearer at hand than that of the brilliant natural "transformation scene" which Professor Sargent writes about in the preceding pages, the article, based as it is upon the latest botanical investigations, will be found of unusual interest, and worthy of being borne in mind until the autumn months come round once more.

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The death of Professor Edward L. Youmans, which occurred in New-York City on Jan. 18, has left a vacancy in the ranks of American scientists which will not soon be filled. Professor Youmans's work was largely of a literary nature; and his *Class-Book of Chemistry*, published in 1852, came into extensive use. He was also well known as a lecturer, and was one of the most ardent supporters of the doctrines of Darwin, Huxley, Spencer, and other philosophers of the evolutionary school. He projected, in 1871, the *International Science Series* of works by eminent authors in different countries, and in 1872 established the *Popular Science Monthly*, of which he remained in charge up to the time of his death. Although prevented by defective eyesight from giving much attention to original investigation, few men have done more than he to popularize scientific knowledge, and familiarize American readers with the works of European scientists.

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The venerable Marshall P. Wilder, a member, and for many years president, of the Massachusetts Horticultural Society, has also recently passed away. Although his loss will be keenly felt by his friends and associates, there can be but little to regret in the peaceful close of such a long, useful, and honorable life.

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At the time of writing, the great telephone case on trial at Washington bids fair to be decided in favor of Professor Bell. Although it is very probable that other inventors were at work on the problem simultaneously with Bell, there can be but little doubt that he was the first to successfully transmit articulate speech over a wire. We were present at one of the first public exhibitions of the new invention, at Salem, Mass., in 1876, and well remember the remarkable success obtained in communicating with Boston, twenty miles distant, over a telegraph wire, and under the most disadvantageous circumstances. Nothing was then heard about the claims of Drawbaugh or Reis; and not till the immense pecuniary value of the telephone became evident, were any claims of previous discoveries put forward. Professor Bell is one of the few inventors who have reaped the financial rewards of their own discoveries; and, unless stronger evidence can be brought forward than has heretofore been made public, every fair-minded person will rejoice to see his title to the property confirmed.

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Professor Liebreich of Berlin has recently published an account of what he calls the "dead space" in certain chemical reactions. He observes, that, when reaction takes place only some time after mixing certain liquids together, it does not occur throughout the whole liquid; in some parts a space is left, in which no reaction is seen. The descriptions hitherto published are not very definite, but it appears that the size and position of the space in a liquid in which the reaction takes place is somewhat dependent upon the size and shape of the vessel in which it is contained. It is best observed in vessels of membranous structure, — like a bladder, for instance, — in which the reaction only takes place in the centre of the liquid in the shape of a yolk of an egg. We shall await more detailed accounts of this discovery with interest, as it apparently is of the highest importance.

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We have recently been informed of the case of a gentleman who was born left-handed, but by continual practice acquired sufficient dexterity to use both hands equally well. Two of his sons, now in their childhood, are commencing to develop the same facility in the use of either hand. As a possible example of the inheritance of an acquired habit in the first generation, the instance is worthy of notice.

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THE GENESIS OF THE ELEMENTS.

There are, in round numbers, about seventy substances known to chemists as elementary bodies; and all other kinds of matter are formed by the combination of two or more of these elements. In fact, the greater part of the earth's crust, and all compounds of animal or vegetable origin, are formed from about a dozen of these seventy elements, which, so far, chemists have been unable to decompose into any simpler form.

The address delivered last summer before the British Association for the Advancement of Science, by William Crookes, F.R.S., is devoted to the question of how far the supposed elements may be considered as ultimate and primitive forms of matter, and the consideration of the various theories and speculations regarding their connection with each other, with the possibility of their derivation from a single material, which Professor Crookes provisionally calls *protyle*.

It would be impossible to do full justice to this address in the space at our command, and we can only glance at the principal facts and theories referred to by him in his discussion of the subject.

We may say, in the first place, that we have no *direct* evidence of any change of one element into another. The most powerful forces at our command have been tried in vain. Iron is always iron, and hydrogen, hydrogen, under any and all conditions to which we can subject them; and it is only by the aid of analogy, and the observed inter-relations of the supposed elementary bodies, that we are enabled to refer them to a common source.

Perhaps the most important fact in this connection is the periodic law of the elements discovered by Mendeljeff and Meyer, which has been fully explained in previous numbers of this journal. Without repeating it, we may briefly say, that, when the elementary bodies are arranged in the order of their atomic weights, from hydrogen (1) to uranium (240), they are observed to form groups of elements in which the chemical and physical properties vary with great regularity; so that, by observing any break in the series, we can predict what the properties of the element will be when discovered, which is to fill the vacant space. Since this periodic law was observed, the metals gallium and scandium have been discovered, and fit into two vacant places in the series quite accurately. It has also been pointed out by Professor Reynolds of Dublin, that, in the different groups, the variation of their properties appears to proceed in a zigzag or oscillatory manner, like the swing of a pendulum. Thus, chlorine, the seventh member of Mendeljeff's third period, contrasts sharply both with sodium, the first member of the same series, and with potassium, the first member of the next series; whilst, on the other hand, sodium and potassium are closely analogous. The six elements whose atomic weights intervene between sodium and potassium, vary in properties, step by step, until chlorine, the contrast to sodium, is reached. But from chlorine to potassium, the analogue of sodium, there is a change in properties, *per saltum*.

The meaning of this wonderful connection between the elements, we do not as yet fully understand; but it must mean *something:* and it is certainly, as Professor Crookes says, "The more I study the arrangement of this zigzag curve, the more I am convinced that he who grasps the key will be permitted to unlock some of the deepest mysteries of creation."

He is inclined to think that it may indicate the formation of different elements from the original protyle, and gives the following speculation in regard to their genesis: —

Of all the known elements, the one of simplest structure and lowest atomic weight is the first to come into being. For some time hydrogen would be the only form of matter (as we now know it) in existence; and between hydrogen and the next-formed element there would be a considerable gap in time, during the latter part of which the element next in order of simplicity would be slowly approaching its birth-point. Pending this period, we may suppose that the evolutionary process which was soon to determine the birth of a new element would also determine its atomic weight, its affinities, and its chemical position. In the original genesis, the longer the time occupied in that portion of the cooling-down during which the hardening of the protyle into atoms took place, the more sharply defined would be the resulting elements; and, on the other hand, with more irregularity in the origi-

nal cooling, we should have a nearer approach to the state of the elemental family such as we know it at present. In this way it is conceivable that the succession of events which gave us such groups as platinum osmium and iridium, palladium ruthenium and rhodium, iron nickel and cobalt, if the operation of genesis had been greatly more prolonged, would have resulted in the birth of only one element of these groups. It is also probable, that, by a much more rapid rate of cooling, elements would originate even more closely related than are nickel and cobalt, and thus we should have formed the near-allied elements of the cerium, yttrium, and similar groups; in fact, the minerals of the class of samarskite and gadolinite may be regarded as the cosmical lumber-room where the elements in a state of arrested development — the unconnected missing links of inorganic Darwinism — are finally aggregated.

The groups referred to in the extract quoted above, — the platinum, palladium, and iron, — and the elements found in the minerals samarskite and gadolinite, have a very important bearing on the question. These elements closely resemble each other in their chemical and physical properties. In the cerium, yttrium, and allied groups, we do not yet fully know how many elements the groups contain, or whether those at present considered as elements are not really compounds of slightly varying substances. In fact, the "elements" of these last-named groups appear to so blend into each other, that it almost seems as if a transformation into one another occurred under the manipulations of the chemist in trying to separate them. Professor Crookes is at present working upon these bodies, and we may in the future expect from him much light upon the subject.

In the first-named groups — iron, platinum, and palladium — the resemblances are less marked, but still very close. Nickel and cobalt, of the iron group, have almost identical atomic weights, and otherwise resemble each other so closely that it has been said, that, had their compounds been colorless, they would have been long regarded as identical, and possibly even yet would not have been separated. Even at present the complete separation of these two metals is one of the most difficult operations in quantitative analysis. Now, in nature we always find these allied elements occurring together. The minerals samarskite and gadolinite, as stated above, contain an indefinite number of closely allied metals; ores of nickel almost always contain cobalt, and *vice versa;* while the occurrence of iron and nickel in meteorites is a matter of common observation. The chances, that, in the cooling of the earth from a molten or gaseous condition, these substances would accidentally come together, is infinitely small; but if we admit the possibility of a sort of inorganic evolution, the whole matter is at once explained.

The existence of compound radicals like cyanogen, is another argument in favor of the compound nature of the elements. This substance, although a compound of carbon and nitrogen, acts in every way like a simple element; the only difference being, that we can decompose it into its constituents. If, from lack of knowledge, this had not yet been accomplished, cyanogen would be among our list of elementary bodies. If this is the case, why is it not reasonable to assume, that, with increasing knowledge, some of the bodies at present considered elementary, may be separated into two or more simpler substances?

An argument not referred to by Professor Crookes, and therefore brought forward with much hesitation, can, we think, be found in the dual nature of certain elements. Not to mention the allotropic forms of carbon, sulphur, or boron, the two classes of compounds formed by iron and many other elements may be spoken of. A class of salts of iron, known as *ferrous* compounds, resemble in their characteristics the salts of zinc; while the *ferric* salts are more closely allied to those of chromium. If we neglect the fact that both classes can only be reduced to the same metallic iron, we can say that the salts of the metals nickel and cobalt resemble each other much more closely than those of ferrous and ferric iron. Is it not possible that this is an indication that the element known as iron may be a compound substance, or even a hint of a change from one element to another, taking place before our eyes?

Some interesting thoughts suggest themselves in connection with this subject. Shall we be obliged in the future to admit that the old alchemists had a clearer conception of the nature of matter than our modern scientists? Must we even believe that those among them who claimed to have solved the problem of the transmutation of metals, had really stumbled upon some chemical reactions of which we at present are totally ignorant, instead of being the unconscionable swindlers that we have always considered them? Suppose copper could be cheaply transformed into silver, or lead into platinum or iridium, what a revolution it would make in the industries of the world! and what a welcome change in our households, if the lead, copper, and tin water-pipes and kitchen utensils, could be supplanted by the clean, unoxidizable metals, platinum, iridium, or silver!

Although it is scarcely possible that any change of this sort can take place under the conditions at present prevailing on the earth, yet the possibility of more favorable conditions occurring at some remote period in the history of the universe may be worthy of consideration. As Professor Crookes says, in concluding his address, "we cannot, indeed, venture to assert positively that our so-called elements have been evolved from one primordial matter; but we may contend that the balance of evidence, I think, fairly weighs in favor of this speculation."

HOW AN ICICLE IS FORMED.

The beautiful fringes and spears of ice which in winter so often decorate the eaves and projecting points of buildings, owe their formation to certain physical laws which may be interesting to consider; for so common a phenomenon as the growth of an icicle, even, is not as simple as might appear at first sight.

Icicles are never formed in very cold weather, and less frequently on the northern sides of buildings, protected from the sun. Also, paradoxical as it may seem, they are rarely formed except upon moderately warm and sunshiny days. The most favorable conditions are a temperature a little below the freezing-point, and an unclouded sky. Under these circumstances, if a roof or any projecting point on a building is covered with snow, an abundant crop of icicles soon grows from the lowest points, hanging downwards into the air. The processes of melting and freezing apparently occur together; and the question arises, How can this be possible? To answer this question, some consideration of the laws of heat is necessary.

The rays of heat radiated from the sun, in passing through the air, do not raise its temperature. The heat only becomes *sensible* when it falls upon some body capable of absorbing it, whereby its temperature is raised; and the heat thus rendered sensible is then given out again, warming, by *conduction*, the air or any body in contact with it. This can be proved in many ways. A mercurial thermometer held in the sun's rays, and not in contact with any other body, will show but little rise in temperature, the radiant heat being reflected from the bright surface of the mercury, like light from a mirror; but, if the bulb be coated with lampblack or some absorbent of heat, a rise in temperature will be indicated at once. So the heat-rays from the sun may be passed through a lens of ice, and concentrated to a sufficient degree to ignite combustibles placed at the focus, without melting the ice of which the lens is formed.

As a general rule, bodies which are the best radiators of heat are also the best absorbents, and rough, dark-colored surfaces possess these properties in the greatest degree. Thus, tea or coffee will remain hot much longer in a brightly polished vessel than in one of rough, dark-colored metal, on account of the greater power of the latter to radiate away the heat. For a similar reason, steam radiators for heating rooms are most effective when they are left the natural color of the iron, without painting or polishing. The rise of temperature in a greenhouse is due to the absorption of heat-rays by the dark-colored soil and contents, and the heating of the confined air by contact with them; and the low temperature of mountain-tops and elevated regions is due, in part at least, to their distance from the surface of the earth, which absorbs the radiant heat of the sun, and gives it out again to the air directly in contact with it. The ice covering a pond or river, being a non-absorbent, will remain solid in the same sunshine that rapidly melts the snow which lies upon the absorbent soil of the roads or fields.

A very simple experiment will illustrate this important principle more clearly. Take two ordinary baking-pans, one of new, bright tin, and the other of common sheet-iron, and hold both before an open fire. The radiant heat will be reflected from the tin pan, which will remain cold; while the iron one will absorb it,

and become hot. If the two pans are placed on the top of a stove, heating takes place by *conduction*, and both are warmed in about the same time.

Now, to return to our icicle, we can easily see how this principle explains its formation. The sun's rays, striking upon the roof, are absorbed, and the heat, thus rendered effective, melts the snow, and the water trickles down to the eaves; but as soon as a drop of water comes into the cold air, it freezes again, and each successive drop, as it flows down from the roof, leaves a portion of its substance upon the rapidly growing icicle. As the water reaches the upper portion first, that part attains the greatest size, while it tapers to a point at the lower end.

Many accidental causes tend to vary the form of an icicle. The supply of water may be irregular or intermittent, and the rapidity of the flow may determine whether it will be stout and short, or slender and sharp. If the wind is blowing during its growth, it will incline to an opposite direction. Sometimes a second icicle will branch out from the original one, and, more rarely, the central part will remain unfrozen, forming a tube of ice.

Stalactites, as found in caves in limestone regions, are formed in a manner similar to icicles, except that they are composed of solid limestone or calcic carbonate, instead of ice. Water charged with carbonic-acid gas will dissolve a small quantity of limestone, which is afterwards deposited upon evaporation. In this way, during long ages of time, some caverns, notably those of Luray in Virginia, have become almost filled with these stalactites of every conceivable size and shape, forming a scene of beauty which is almost unparalleled.

[Specially reported for the *Science News* from the Observatory of the College of New Jersey.]

ASTRONOMICAL PHENOMENA FOR MARCH, 1887.

The sun reaches the vernal equinox on March 20, at 5 P.M., Washington time. The first few days of the month are the most favorable time of the year for seeing Mercury. It appears as an evening star in the west, a little to the north of the sun, soon after sunset. It reaches its greatest elongation east of the sun about noon on March 5, on which date it sets about an hour and a half after the sun. Venus is also an evening star, gradually increasing its distance from the sun. At the close of the month it sets about two hours after the sun. During the first few days of the month it is 4° or 5° above Mercury. Mars is also in the same part of the sky, but is too faint to be seen. Jupiter rises about 15° south of the east point, at about 10 P.M. on March 1, and two hours earlier at the end of the month. It is about 15° east of the first-magnitude star Spica (*Alpha* Virginis), and a little to the south. Saturn crosses the meridian at 8.30 P.M. on March 1, and at 6.30 on March 31. It is nearly stationary among the stars, moving slowly westward until March 17, when it begins to move eastward; the whole motion is, however, less than half of the moon's diameter. It is in the constellation Gemini, and at the southern angle of a triangle formed by it with Castor and Pollux (*Alpha* and *Beta* Geminorum). Uranus rises about two hours before Jupiter, and is in opposition with the sun, and on the meridian, about midnight at the end of the month. It is of the sixth magnitude, and not very near any bright star. The nearest is *Gamma* Virginis, third magnitude, about 3° north-west of the planet. Neptune is about 6° south of the Pleiades, but too faint to be seen without a telescope.

During January three comets were discovered, the first, by Thome at Cordoba, in the Argentine Republic, on Jan. 18. It is in the constellation Grus, and too far south to be visible in the United States. Its orbit is like that of the first comet of 1880, and it is predicted that it will be a brilliant object. The other two are faint, and were discovered on Jan. 22 and Jan. 24, — the former by Brooks of Phelps, N.Y., in the constellation Draco; the latter by Barnard of Nashville, Tenn., in the constellation Vulpecula. M.

Princeton, N.J., *Feb.* 1, 1887.

METEOROLOGY FOR JANUARY, 1887.

TEMPERATURE.

Average Thermometer.		Lowest.	Highest.	Range.
At 7 A.M.	17.26°	−14°	50°	64°
At 2 P.M.	28.13°	11°	51°	40°
At 9 P.M.	21.61°	0°	47°	47°
Whole month	22.33°	−14°	51°	65°
Second average	22.15°	−14°	51°	65°
Last seventeen Januarys,	23.87°	17.50°	32.98°	15.48°
Second average	23.63°	17.32°	32.65°	15.33°

The 3d was the coldest day of the month, with an average of 3⅔°. The 8th and 19th were 4°. The 29th was the warmest day, at 45⅓°. The lowest point reached, 14° below zero, was on the 19th; and the highest, 51°, on the 29th. The mercury went below zero six morning during the month, with several sudden changes. On the 19th it rose from 14° below zero to 14° above, or 28° in seven hours; and in twenty-four hours it went down 42°, ending 3° below zero on the morning of the 27th. There were four distinct cold waves during the month, when the mercury went below zero. Indeed, the entire first twenty days of the month may be considered one continued cold wave, as the mercury was below zero five mornings, and reached 35° but twice at the hours of observation, and the whole average was but 16.48°; while the remaining eleven days averaged 32.97°, and that notwithstanding a cold wave in the midst, on the 27th. The entire month was only 1.72° below the average of the last seventeen Januarys.

PRESSURE.

The average barometer the past month was 29.927 inches, with extremes of 29.30, on the 17th, and 30.49 on the 4th. The average for the last fourteen Januarys has been 29.960, with extremes of 29.840 and 30.080 The sum of daily variations was unusually large, being 10.65 inches; giving an average daily movement of .343 inch, exceeded but four times in fourteen entire years. This average for the last fourteen Januarys has been .285, with extremes of .196 and .391. The largest daily movements the past month were .63 inch, on the 25th, .61, on the 21st, and .59, on the 24th, — all in near connection with a heavy rainstorm. The barometric waves were short, with one exception near the middle of the month.

SKY.

The face of the sky in 93 observations gave 42 fair, 9 cloudy, 31 overcast (just one-third), 3 rainy, and 8 snowy, — a percentage of 45.2 fair. The average for the last seventeen Januarys has been 53.4 fair, with extremes of 40.9 and 61.3; showing the past month to have been unusually cloudy and stormy. The morning of the 30th was quite foggy; the 16th and 18th furnished beautiful sunsets.

PRECIPITATION.

The amount of rainfall, including 24 inches of melted snow, was 7.39 inches. Rain or snow fell on about one-third of the days. On the 5th and 6th about 9 inches of snow fell, restoring good sleighing, which continued through most of the month. The average amount of precipitation the last nineteen Januarys has been 4.63 inches, with extremes of 1.80 and 7.76. The last three Januarys have had nearly the same amount as the present, much above the average. Warm and heavy rains near the close of the month removed the heavy body of snow.

WINDS.

The direction of the wind in 93 observations gave 24 N., 1 S., 3 E., 26 W., 0 N.E., 20 N.W., 0 S.E., and 19 S.W., — an excess of 24 northerly and 62 westerly over the southerly and easterly, and indicating the prevailing direction to have been W. 21° 15′ N. The northerly winds have uniformly prevailed over the southerly, with two exceptions, for eighteen years, by an average of 19.33 observations, and the westerly over the easterly, without an exception, by an average of 53; thus indicating the approximate average direction for January to be W. 20° 2′ N. The longitudinal extremes have been 14 W., in 1877, and 88 W., in 1879; and the latitudinal 53 N., in 1886, and 9 S., in 1870. The relative progressive distance travelled the past month was 66.49 units, and during the past eighteen Januarys 1,016 such units, — an average of 56.44. D. W.

Natick, *Feb.* 5, 1887.

Correspondence.

Brief communications upon subjects of scientific interest will be welcomed from any quarter. The editors do not necessarily indorse all views and statements presented by their correspondents, and will return to the writers such communications as are not considered of sufficient interest for publication.

BACTERIA: THEIR CLASSIFICATION AND RELATION TO HIGHER FUNGI.

Editors Science News:

From a careful and somewhat comprehensive examination of the so-called micrococci and bacteria, embracing many hundred different experiments, and selected from more than fifty different orders of cryptogamous as well as phænogamous plants, I am forced to the conclusion, that all the present methods of classification need the most searching revision.

Indeed, it seems probable to me that the whole order of schizomycetes may be abandoned; the common notion, that their reproduction is wholly or mainly by binary subdivision, being to my mind erroneous.

If we can, by carefully watching the process in individual members, once establish the fact that a few so-called species develop into higher forms, the way is opened for a proper study of other forms having a similar origin.

Selecting at first some large forms that were easily studied under a moderate magnifying power,

from a thousand to fifteen hundred diameters, the following facts were observed: The entire protoplasm of the vegetable cell undergoes at first (through what agency I do not pretend to say) a sort of irregular segmentation, whereby linear or angular bodies of unequal size are formed, within which minute highly refractive bodies $\frac{1}{50000}$ to $\frac{1}{100000}$ of an inch diameter appear, which enlarge, and assume the character of a nucleus, and around which and out of the containing angular or linear body, a globular or bipartite, oblong, active being — micrococcus bacterium — is formed. The globular forms are almost always at first solitary; but, after attaining the size of about $\frac{1}{25000}$ of an inch in diameter, they usually unite by pairs, which seems to be, from its close resemblance to the same process in some algæ, a true sexual conjugation. These do not coalesce, but form around themselves a common cellulose envelope, and then might be called a spore. From these, and the oblong, bacteria-like bodies, are developed, by simple growth or sprouting, according to surrounding circumstances, —

1st, Leptothrix, — mostly aquatic, thread-like filaments, ultimately breaking up into forms like the parent cell.

2d, Torula, — aquatic and perhaps asexual forms, growing by budding, and occasionally, but not generally, forming filaments or threads.

3d, Filamentous fungi, which have been traced into Pencillium, Mucor, and the various parasitic species called rust, smut, mildew; Puccinia, Peronospora, Uslitago, etc. Whether any of the various forms develop into the higher fungi, like Agaricus (mushrooms), Truffle, etc., I have not so far been able to make out with certainty; but certain facts seem to point to such a conclusion.

All animal matters, including pus from all sources, blood, muscular and connective tissue, give rise to bacteria in almost exactly the same manner; but whether they all develop into filamentous forms, I cannot say. Some of the protozoa and protophyta, especially amœba and protococcus, are developed from micrococci, which at first cannot be distinguished from those that form fungi. If these facts are admitted, the empirical character of a classification so indiscriminately mixing beings whose destiny is so different, can be readily understood; and much of the theorizing about the entrance of these organisms into the interior of living beings of a higher order may be found unnecessary.

Luther Pattee.

Manchester, N.H., *Jan.* 12, 1887.

FALL OF ROCKS AT NIAGARA.

On the morning of the 12th of January, at a quarter to one o'clock, there was an immense fall of rock at Niagara Falls, on the Canada side. The whole of the remainder of what was called Table Rock has fallen this time. This was a projection of the surface-rock over the precipice immediately adjoining the Falls, over a part of which some of the water poured. The waters at the centre of the Horseshoe, having cut back the rock some three hundred feet within the last forty years, have left a long and comparatively narrow remnant of the Table Rock. It is this last remnant that has fallen. At the lower end it was about twenty feet wide, as near as can be estimated; and it is claimed by the residents that the upper end was one hundred and forty-four feet wide. Estimating the length, by pacing along the bank of the river, I find that it must be at least five hundred feet long. This would amount to forty thousand square feet, or slightly less than one acre, of rock-surface that has fallen away. Of course, this may be an exaggeration; I mention it only as an estimate made by observers on the spot. Accurate surveys will, doubtless, soon determine more precisely the amount of rock that has fallen. The long, triangular piece that has fallen has effected a straightening of the verge of the precipice, giving a better view of the Falls on the Canada side.

H. J. Seymour.

Niagara Falls, N.Y., *Jan.* 13, 1887.

QUESTIONS AND ANSWERS.

Letters of inquiry should enclose a two-cent stamp, as well as the name and address of the writer, which will not be published.

Inquiries sometimes unavoidably remain unanswered till issue of the second number after they are received.

Questions regarding the treatment of diseases cannot be answered in this column.

T. C. G., *Maryland.* — What is the difference between a barometer and thermometer? Does the mercury move in a vacuum in both instruments?

Answer. — In the barometer the column of mercury is balanced against the atmospheric pressure, and moves up or down as the pressure varies. In a thermometer the tube is entirely closed from the air, and the movements of the mercury are due to its expansion or contraction by heat or cold. In both cases there is a nearly perfect vacuum above the mercury column.

M. O. B. — If the temperature increases as we approach the earth's centre, why is there not an increase of temperature observed in deep-sea soundings?

Answer. — The constant circulation of water in the ocean would prevent any noticeable iucrease of temperature from this cause. If the water at the bottom of the sea should become even slightly warmed, it would expand, and immediately rise towards the surface; while colder water would flow in to take its place.

E. B., *Massachusetts.* — A holosteric barometer is the same as an aneroid. It is not necessary to place it out of doors. They are usually properly adjusted before being sold, but are provided with a regulating screw, by which, if great accuracy is desired, they can be made to agree with a standard mercurial instrument. Mercurial barometers are considered more accurate than aneroids; but for ordinary use, the latter are cheaper and more convenient, and equally useful.

J. C. F. — Are plants kept in living or sleeping rooms injurious to health?

Answer. — We do not consider that they are injurious in any way unless their number is so great as to keep the air of the apartments damp. They decompose carbonic-acid gas into carbon compounds and oxygen, and in this way tend to purify the air. They may also be of indirect benefit, by leading the occupants of the room to keep the air free from coal-gas and other impurities in which plants will not flourish.

W. S. N., *Pennsylvania.* — How many articles can be made from coal-tar?

Answer. — The number is indefinitely large, and it would require several pages of the *Science News* to catalogue those at present known.

N. J. Robinette, *Flag Pond, Va.*, writes that he will send specimens of the minerals and fossils of that section to any one who is willing to pay mailing expenses, and properly name and classify them for him.

W. A. B., *New Hampshire.* — The effect of the water upon your zinc tank is not unusual, although in this case the action appears to have been remarkably rapid. For this reason, zinc-lined tanks or galvauized iron pipes are unfit to contain water for drinking or cooking purposes.

S. B. P., *New York.* — Hair-dyes containing lead will not give the violet color to the hair, as do those containing silver salts; but they are even more injurious to the health. The juice of the outer covering of walnuts gives a brown color, and is unobjectionable, from a hygienic point of view at least.

P. S. S., *Connecticut.* — We know of no way to remove smoke-stains from a marble mantel. Perhaps some of our readers can furnish the desired information.

J. P. D., *Vermont.* — No very cheap process for producing aluminium has yet been devised, though many persons are at work upon the problem. The Cowles electric furnace, described in the *Science News* for January, 1886, is one of the best of the recent inventions in this direction.

LITERARY NOTES.

Commercial Organic Analysis. By Alfred H. Allen, F.C.S. Vol. II. P. Blakiston, Son, & Co., Philadelphia. Price $5.00.

The second volume of this important work is devoted to the analysis of the fixed oils, higher fatty acids, and hydrocarbons derived from petroleum, and those of the aromatic series. The present is the second edition, and contains the latest discoveries in analytical chemistry. The descriptions are clear and concise, and the book is remarkably free from errors. Professional chemists, manufacturers, and pharmacists will find in this a work to which they can refer with confidence, and a certainty of finding every thing of value known respecting the composition and assay of organic products.

Mineral Resources of the United States. Published at the Government Printing-Office, Washington.

This annual report of the United States Geological Survey for the year 1885 contains much scientific information of the highest value and interest. It contains articles upon all the principal mineral products of the country, among which natural gas and tin ore have a special interest at the present time. It can be obtained by sending a forty-cent postal-note to the Director United States Geological Survey, Washington, D.C.

Professor H. M. Whelpley of the St. Louis College of Pharmacy has published *Chemical Lecture-Notes*, taken from Professor Curtman's lectures delivered at the college. The author has succeeded in condensing into the pages of this little volume a very large amount of chemical and physical information, which is, of course, especially adapted to the use of pharmaceutical students. Price $1.00. For sale by the author.

Cupples, Upham, & Co. of this city have published a religio-philosophical poem by E. A. Warriner, entitled *I am that I am.* It is described on the titlepage as "A Metrical Essay, in three parts and nine cantos," and persons interested in such subjects may possibly profit by its perusal. Price $1.00.

A new game issued by the Interstate Publishing Company of Boston is entitled *Literary Salad*, and will prove a pleasant means of becoming familiar with the authorship of many familiar quotatious whose origin is not generally known. Price 50 cents.

Scribner's Magazine, the latest candidate for public favor, commences the year with two most excellent numbers. The numerous illustrations are fully up to the standard required by modern magazine-readers, and we trust it will obtain the success it merits. Charles Scribner's Sons, New York. Price $3.00, or, with the *Science News*, $3.55.

The Swiss Cross, a new monthly journal of science for young people, improves upon acquaintance, and makes good its claim that a thoroughly scientific magazine may be so conducted as to be highly attractive to unscientific readers. It is now the official organ of the Agassiz Association, and is published by N. D. C. Hodges, 47 Lafayette Place, New York. Subscription price, $1.50 a year; $2.25 with *Science News*.

The Journal of Analytical Chemistry is another addition to the list of scientific periodicals. It is edited and published by Professor Edward Hart of Lafayette College, Easton, Penn., who has the co-operation of a long list of eminent chemists. The first number contains, among other valuable articles, a paper by Professor V. C. Vaughn upon Tyrotoxicon, the newly discovered milk poison which has created so much discussion. Price $3.00 per volume.

Pamphlets, etc., received: *Monographs on Education: Mathematical Teaching*, D. C. Heath & Co., Boston (price 25 cents); *On a New Series of Berlin Wools for the Detection of Color-Blindness*, by Charles A. Oliver, M.D.; *The Foundation and Work of the Blue Hill Meteorological Observatory*, by E. A. Rotch; *History and Work of the Warner Astronomical Observatory*, by Professor Lewis Swift; *Discussion on the Source of the Mississippi*, reprinted from *Science*; *Presumption of Brains* (educational), New England Publishing Company, Boston (price 10 cents); *Classification of the Macrochires*, by R. W. Shufeldt; *Report on Diseases of the Rectum*, by M. J. Mathews, M.D.; *Annual Address of the President of the Detroit Medical Association*, by C. J. Lundy, M.D.; *Address delivered at the Funeral of George M. Maclean, M.D., of Princeton, N.J.*; *Reasons for the Repeal of the New York Medical Law*; *Bulletins* of the Minnesota State Board of Health and the New Jersey Agricultural Experiment-Station; and the *Quarterly Report* of the United States Bureau of Statistics.

Medicine and Pharmacy.

SOME FACTS CONCERNING THE HUMAN BRAIN AND MENTAL PHENOMENA.

II.

We have seen that the brain, reduced to its simplest elements, consists of cells with connecting filaments, and blood-vessels. By means of this simple apparatus are evolved all those primitive forces which, in one way or another, are essential to the mental phenomena. The various combinations of cell and vessel furnish the requisite variety of particular results. The vital force which keeps them in activity, and thus secures the fulfilment of their appropriate functions, is called excitability, and, of course, supposes an exciting agent. In the healthy state, this activity of the one and the other is *exactly balanced*, and the function is perfectly performed. Hence it is, that a well-balanced mind or intellect is self-poised, — not easily disturbed by unusual or erratic influences. It maintains its equilibrium, and makes but few mistakes, but seldom rises above mediocrity.

The question then arises, What is genius? To what state or mental condition shall we attribute those phenomena which are witnessed in the great leaders in the realm of thought? Those who have given impulse to the dead level of ordinary thought, and startled the world with new ideas? Does genius, so called, depend upon a healthy, or unhealthy, state of mental activity? Is it simple excitation, or *super*-excitation? Sir William Hamilton affirms that the difference between a common mind and the mind of a Newton consists principally in the fact, that the one is capable of more continued action than the other; that a Newton is able, without fatigue, to connect inference with inference in one long series toward a determinate end, while the man of inferior capacity is soon obliged to let fall "the thread which he had begun to spin."

Bacon also places all men "of equal attention" on one level, recognizing nothing as due to genius. Helvetius goes so far as to say that "genius is indeed nothing but continued attention." Buffon also speaks of it as "a protracted patience." "In the exact sciences," says Cuvier, "it is the patience of a sound intellect, when invincible, which truly constitutes genius."

According to these interpretations, genius is merely a normal activity of the nerve-cells, carried to the highest degree of which it is capable.

On the other hand, Moreau, the celebrated French scientist, after long and patient research in mental phenomena, has asserted that "genius is incipient insanity." Uninspired by this abnormal condition, he asserts that the conceptions of Shakspeare, of Newton, or Cuvier, would have scarcely been distinguished from those of ordinary mortals. He expressly declares that the old saying, *mens sana in corpore sano*, is wrong, and that so long as the normal condition of the organism is generally in accordance with the regular action of the thinking faculty, we shall never, or only exceptionally, see the intelligence rising above an honorable mediocrity.

This position, of course, is at variance with the doctrine now generally accepted by physiologists, and already stated, — that the mental power and excellence displayed by any individual depend chiefly upon the size of the brain, the proportion of its parts to one another, and the quality of its elementary materials. Moreau's conclusion, that the nervous super-excitation that leads to diseases is "identical" with that which gives rise to the sublimest conceptions of human thought, although bold and brilliant, must be received with broad exceptions. The cases which are cited in proof of this theory are interesting as curious examples of mental phenomena, where the brain is under the severe strain of long-continued application.

Thus, Archimedes, at the taking of Syracuse, was so absorbed in a mathematical calculation, that he merely exclaimed to the soldier who was about to kill him, "Noli turbare circulos meos!" Newton's absence of mind is well known; he frequently forgot to dine, and on one occasion it is said that he used his lady's finger as a tobacco-stopper. Alcibiades relates of Socrates that he was often so absorbed in the consideration of a weighty subject, that he would stand all night with his face fixed, unconscious of day or night. Sir William Hamilton relates, that the mathematician Victa was sometimes so wrapt in meditation "that he seemed for hours more like a dead person than a living, and was then wholly unconscious of every thing going on around him."

In this curious study, we all know that abnormal conditions of the brain are often accompanied with remarkable manifestations of intellectual power. We can cite cases where blows on the head, attacks of fever, the approach of cerebral lesions, produced a revival of memory, a quickness of perception, an exaltation of the imagination, quite foreign to the patient's usual condition. The connection between the higher forms of intellectual power and mental disorder has been curiously recognized by men of genius. Thus, Aristotle says, "No great genius without a mixture of madness." "The extreme mind is near to extreme madness," says Pascal. "Genius bears within itself a principle of destruction, of death, of madness," asserts Lamartine. And we are familiar with Dryden's famous verse: —

"Great wits are sure to madness near allied."

That there is unusual excitement in the mechanism of the brain, by which the highest forms of thought are evolved, we have glimpses in the records of some who have achieved fame in science, literature, and art. "When I apply myself with attention," says Metastasio, "the nerves of my sensorium are put into a violent tumult, so that I grow red in the face, like a drunkard, and am obliged to quit my work." Rosseau tells us, that, when the idea of one of his works flashed on his mind, he experienced a nervous movement, that appeared like a slight delirium. Descartes, amid those reveries of his youth which led to the grand achievements of his mature years, "heard a voice in the air" that called him to pursue truth. Sir Joshua Reynolds said, that, when walking abroad one morning after severe work at his art, he "saw men as trees walking." From such facts and statements the conclusion seems fairly drawn, that, in that intellectual process which we call genius, there is *unusual excitation* of the nerve-cells of the brain. But we are hardly prepared to accept the proposition that this peculiar organic condition, which readily passes into diseases, is "essential" to the highest forms of intellectual effort; or, in the words of Moreau, "that genius is incipient insanity."

HUNGER.

The power of hunger is proverbial: it "breaks through stone walls." Carlyle, or somebody else, says, that the two great moving forces of society are hunger and the policeman. "Hunger impels people to eat: the policeman forces them to work for their food, instead of stealing it." Much has been written on "the nobility of labor," but the average man does not toil because he believes it noble to do so. He is more inclined to look upon labor from the Scriptural point of view, — as a curse imposed on Adam when exiled from the Paradise where he had no care about clothes, and little about food. This is not the philosophy of the mere "tramp," but of better and wiser men, if they are honest withal. Thackeray declared that the worst defect he was born with was "a strong disposition to easy-going indolence;" and Charles Lamb frankly recorded his natural hatred of work, which he was inclined to regard as one of the social nuisances invented by the devil. Buckle, looking at the matter with scientific eyes, asserts that civilization, the most direct result of toil, appears earliest in regions where man has either to endure hunger, or to work in order to get food. The bounty of nature is a primary cause of barbarism, for the savage will be indifferent to his low estate until he is roused to ambition and activity by the spur of famine. It is to the ease with which they can live, quite as much as to the enervating influences of the climate, that the indolence of tropical races is due.

But what is hunger, from a physiological point of view? Everybody knows by experience what its preliminary manifestations are; but comparatively few, especially in our own land, have felt the keener pangs of absolute starvation. The ordinary sensation of hunger, even if somewhat sharp, is by no means painful. The anticipation of gratifying it is generally the predominant feeling. Hunger only gives a zest to the expected enjoyment of the food that shall satisfy it. But if the food is not to be had, this pleasing sensation soon gives way to a very different one. The "hope deferred" makes the stomach sink within us, and longing becomes a positive

pain, which increases as the strength to resist it diminishes. The inner surface of a healthy stomach in a state of hunger is paler than after it has received food. The minute blood-vessels then become filled with blood, and the surface changes from a light pink to a bright red.

The pain produced by prolonged hunger has been compared to that which might be supposed to be caused by having one's stomach "clutched by two great red-hot iron hands, which kept on, hour after hour, tearing it into shreds and tatters." This, indeed, is essentially what is taking place in the stomach. In an advanced stage of starvation, the body, with cannibal-like desperation, preys upon its own tissues. There are no well-marked physical appearances characteristic of this stage of hunger before positive emaciation sets in. As a writer on the subject has said, "There may be a vulpine gleam in the feverish eye; but beyond that, and the generally dejected and morose expression of the features, there is hardly any thing very peculiar in the visage of the starving man."

It may be noted, as a curious fact, that the terrible prompting to cannibalism in extreme starvation is very rare, except in cases of shipwreck. The best authorities assert, that, as a rule, well-authenticated instances of this kind among civilized people are found to occur only at sea. What is more curious, when the famished victims of shipwreck get on shore, even on the most barren and desolate island, they seem to lose at once all idea of eating one another. An English writer cites the case of Ensign Prenties, who was wrecked, with some of his fellow-soldiers, on the island of Cape Breton, in 1780. "Prenties records that they were able to endure the most fearful pangs of hunger, without ever so much as a thought of resorting to cannibalism for relief, so long, and only so long, as they kept on land. But when they took to their boats, — and it was not once merely that they experienced this, in order to escape from their rockbound prison, — though they were not a whit worse off for food than they were on land, yet the moment they put to sea, with one accord they began to think of killing and eating one of their number. On the other hand, when they found their attempt to escape futile, and put back to shore, whenever they landed, the horrid idea of cannibalism seemed to vanish." The explanation of this may, we think, be due to the fact that the sea-air intensifies the hunger and the consequent desperation of the sufferer, or to the feeling of utter helplessness and hopelessness in an open boat or on a drifting wreck.

In the ultimate stages of starvation, all observers agree that there is a diminution of suffering. After the fifth or sixth day, the sharp edge of hunger becomes dulled; emaciation and weakness appear, feeling is benumbed, and the senses begin to fail. There is no pain, and the mind lapses into "a state of incoherence and sleepless delirium," which in turn passes into the torpor of death.

It is interesting to note here, that the starving man begins to lose flesh before he loses brain-power. We should expect that the delicate machinery of the nervous system would suffer first from lack of nutriment, but it does not show signs of waste until some time after the rest of the body. An animal starved to death is found to have lost only two per cent of nerve-tissue and brain-tissue, when more than forty times as much fat and twenty times as much flesh or muscle have disappeared. Though the fat is the tissue that breaks up soonest, the fat in the brain is scarcely affected by starvation. This explains the sleeplessness and abnormal mental activity which are found to be produced by extreme hunger. The nervous system is relieved from that part of its duty which is concerned in carrying on the functions of nutrition, and expends itself almost exclusively in action within the brain, resulting in sleepless delirium.

The subject, though of much scientific interest, is a painful one, and we are not disposed to dwell upon it overlong. This brief and familiar consideration of the more important phenomena of hunger may serve to remind us that this body of ours is a machine, and, like all machines, it has no capacity for *creating* the power that impels it. As the steam-engine is dependent on supplies of fuel and water, without which it soon becomes a mass of inert metal, so this corporal organization must be furnished with food and drink, or it will soon be but lifeless earth, as incapable of muscular or mental activity as the dust we tread upon. May the reader never know by experience what it is to have the fire go out prematurely for lack of fuel to keep it going!

MONTHLY SUMMARY OF MEDICAL PROGRESS.

COMPILED EXPRESSLY FOR THE SCIENCE NEWS BY W. S. WELLS, M.D.

Not since the war of the Iconoclasts, with which Christendom was distracted for a hundred and twenty years, dating from the edict of Emperor Leo, in the year 726, has a raid upon our household gods been made, likely to create more commotion, in these degenerate times, than that of a New Jersey practitioner who has declared against *toasted bread*.

He speaks of it as "an innocent-looking thing; and yet, like the Grecian horse before the walls of Troy, it works sad havoc when once inside."

While Dr. Hedges of Plainfield deprecates the sacrilege, he cannot forbear giving a few plain facts, from his own experience, to show that toast is not at all times as innocent and free from the capacity to do harm as our progenitors believed. It is dangerous in gastro-intestinal diseases.

He has found it particularly dangerous in convalescence from typhoid-fever, dysentery, and other intestinal affections, and relates cases in which, the patients being fed with toast, severe relapses occurred, one of which proved fatal in a few hours.

It would seem as if the gritty particles of charcoal, insoluble in the juices of the stomach, are shoved up and down over the irritable mucous membrane like so much powdered glass, and, finding their way into the intestine, scratch the inflamed Peyer's patches, renewing the inflammatory action, and endangering perforation.

In the *Revue de Médecine*, Dr. Lépine relates some experiments with mixtures of antiseptic substances. He combined mercuric chloride, carbolic acid, salicylic acid, benzoic acid, bromine, calcium chloride, hydro-bromate of quinine, and chloroform, each in very small quantity; so that, if it was alone in the solution, it would be powerless to prevent the development of bacilli in beef-broth: but the solution, as combined and mixed with an equal amount of bouillon, effectually prevented any development of bacilli. He believes that, by mixing different substances in this way, very powerful antiseptic solutions may be made, which will, at the same time, be entirely devoid of danger to the patient.

Dr. McGuire of Richmond uses chloral hydrate as an antiseptic in his practice. For dressing wounds, absorbent cotton wet with a solution of two grains to the ounce, kept damp, is removed only once in twenty-four hours.

For sore throat from any cause, the above, as a gargle, is mentioned as the best he ever used.

The practice of disinfecting a sick-chamber during the course of an infectious disease, if the patient can be removed into an adjoining room for a few hours daily, while the process is going on, is a good one. The report by Dr. Mohn to the Medical Society of Christiania, upon this plan of treating whooping-cough, was favorably received. Dr. Mohn's method is as follows: —

The patient is robed in clean linen, and taken out of the sleeping-room in the morning, where are left the bedding, linen, clothes, and things that cannot be washed. Sulphur is then burned in the room, in the proportion of twenty-five grams to every cubic meter of space in the apartment.

After five hours, the room is aired, and the patient is returned; the atmosphere is purified and medicated, and breathing it over night usually effects a cure of the whooping-cough within twenty-four hours.

A number of successful cases are reported, in all of which the cough promptly disappeared after one fumigation.

In cases of severe injury to a limb, it is often difficult to determine whether the blood-vessels have been so much injured as to necessarily involve gangrene of the first part beyond the seat of injury. To ascertain if this is likely to follow, Dr. W. S. Lang, F.R.S., Edinburgh, recommends the following procedure to ascertain the probability of the circulation being restored: Gently raise the limb, and keep it raised a few minutes, in order to empty it to some extent of blood. Then apply a piece of elastic webbing on the proximal side of the injury, and keep it applied for about a minute; lower the limb, remove the improvised tourniquet, and, if sufficient circulation remains, the part beyond the seat of injury will blush rosy red, and show that it is viable.

In the case of a boy run over by a tramway car, causing severe compound comminuted fracture of both bones of the leg, so that the limb was "dangling," and looked hopeless, this plan was tried in the Royal Infirmary, Edinburgh.

After having applied the tourniquet as described, it was observed, after removing it, that the dorsum of the foot blushed; and it was resolved to give the limb the benefit of conservative treatment rather than amputation.

Some pieces of bone were removed; and, by drainage and the usual antiseptic treatment of compound fractures, the boy made an excellent recovery, with a useful limb.

A case of strychnine poisoning cured by hypodermic injections of chloral hydrate, is reported

by Dr. J. G. Brown of Liverpool. He found the patient, a woman, with her arms firmly pressed to her sides, her legs rigid, and her back as stiff as a board; so that, in raising her, the body did not bend. The pulse was rapid, and the respirations so shallow as to seem stopped. There was a peculiar hoarse rattling in her throat, and the face assumed a bluish-purple color. Attempts to give an emetic, and to pass an œsophageal tube, failed, and brought on such severe spasms as to prevent renewal.

Then a solution of one in two of chloral hydrate was obtained, and three hypodermic injections, of about eight grains each, were administered. They speedily reduced the spasms; and about a half-hour later a fourth injection was given, and she was able to swallow, when an ounce of tannate of glycerine was given. She recovered.

The views of Dr. Grassi, that insects, especially flies, may be considered as veritable authors of epidemics, and agents in infectious maladies, are strengthened by the investigations of Dr. R. L. Maddox, as explained in a paper read by him to the Royal Microscopical Society.

He believes that the comma bacillus from cultures can pass, in a living state, through the digestive tube of some insects, and, from this cause, insects feeding upon bacilli are likely to become the media of distributing diseases. Instances have been heretofore published of the discovery of living infinitesimal worms carried from one locality to another in the proboscis of the fly, caught after feeding upon substances containing such worms, and examined with the microscope. Such records open up an immense field of possibilities to the imagination of speculative individuals.

Dr. Waxham of Chicago has tried electrolysis in a case of membranous croup, in which the symptoms of contraction of the laryngeal tube were very severe.

An intubation tube was introduced, and made the negative electrode by connecting it with a platinum wire, through which a current of eight cells was passed. The symptoms at once abated, and the child recovered. Perhaps the presence of the tube in the larynx, enabling the child to breathe, had quite as much to do with the cure as the electric current.

French physicians have been experimenting upon rabbits, in order to discover some substance which would render them insusceptible to inoculations of tuberculous matter. They found tannin to act in the manner desired. Six rabbits were treated for a month with doses of tannin varying from fifty centigrams to one gram. Two inoculations were then made, one with lung tissue from a patient who had died of acute tuberculosis, the other with miliary tubercle from a hospital patient.

No trace of infection followed, while three other rabbits, to which tannin had not been given, died in consequence of inoculations with the same material.

Upon this suggestion, over fifty cases of phthisis have been treated by giving tannin in doses of from two to four grams daily; and improvement was perceptible in two weeks, the patients increasing in weight.

The final judgment upon this plan of affording resistance to the action of tubercular virus, is anxiously awaited.

The habit of administering medicines in capsules has received a set-back in the announcement, that, if there is any form of alcohol in the stomach at the time of swallowing the capsule, its gelatine is rendered insoluble. When the stomach has been rendered irritable from excesses in strong drink, medicines should not be given in capsules, as they are not likely to be dissolved.

Tannic acid also renders the gelatine covering insoluble, according to the *Southern Practitioner*.

The walls of a sick-room should be finished in plain, subdued color, instead of papered in fancy patterns, as patients are liable to be rendered irritable and sleepless by prolonged mental perturbation induced by vain efforts to trace problems or in counting combinations. A case of temporary insanity is reported as occasioned by a morbid disposition to solve the possible combinations into squares, of certain figures on the wall-paper of a patient's room, as his mutterings implied, which ceased at once when he was removed to a room with plain walls.

COLLECTIVE INVESTIGATION OF CENTENARIANS.

The late Dr. Farr has shown, in his *March of an English Generation through Life*, that 1,000,000 born in England live 40,858,184 years, that 223 live to the age of 100, and that finally, at the age of 108, one solitary life dies.

In the supplement to the *British Medical Journal* of Dec. 11, Professor Humphry has analyzed the returns from reliable medical men regarding fifty-two centenarians, tabulated from the results of a form of inquiry issued by the Collective Investigation Committee of the British Medical Association. In only eleven was the age confirmed by any official record; but the others were naturally assumed to have at least reached nearly the age of one hundred, the informant in each case being competent to estimate the value of the evidence, and in most of the cases being intimately acquainted with the individual.

In eleven the intellect is stated to have been high, and low in only five; twenty were reported strong, sixteen of average strength, and twelve feeble. Thirty-six were women, sixteen men, — a fact explained by Mr. Humphry partly by the fewer exposures of women, notwithstanding the dangers incidental to child-bearing and the diseases associated with the varying demands made at different periods upon the organs connected with that process, and partly also by the greater inherent vitality in the female.

Of the thirty-six women, twenty-six had been married, eleven had large families, eight married before they were twenty, one at sixteen, and two at seventeen. Many of the centenarians were members of large families, there being but two designated as only children. Forty-one of the fifty-two had been married. Twelve were first children. The parents of one centenarian were first cousins.

The average centenarian qualities were, a good family history, a well-made frame of average stature, spare rather than stout, robust, with good health, appetite, and digestion, capable of exertion, good sleepers, of placid temperament, and good intelligence, with little need of, and little consumption of, alcohol and animal food, although one man always did, and "always will," drink to his utmost capability.

Three were affluent, nineteen poor, and twenty-eight in comfortable circumstances.

Twenty-four of the centenarians had no teeth, and the average number retained was only four or five. Twenty-eight used glasses; but thirty-five, including many who used glasses, were reported to have been in the enjoyment of good sight. Hearing was good in twenty-two, indifferent in seventeen, bad in nine; one was deaf.

The majority were moderate or small eaters, but maintained an average pulse of 70 and respiration of 22, — a fact explained by the diminished elasticity of the circulatory and respiratory apparatus. The arteries had become less capable of accelerating the blood-stream; and the vital capacity of the chest was much reduced, as shown in the slight difference in the chest-girth between the state of inspiration and that of expiration. The hours of sleep averaged nearly nine, the extremes being twelve and four.

The brain held out as well as the other organs, perhaps better; two only were demented. The weakness or failing, generally, seemed to have been about equal in the several great organs.

The majority had suffered little from illness at former periods, yet some had recovered from severe diseases. The habits of life were generally such as conduce to health, necessitated in a measure, at least by some, from their occupations. Thirty-two did not use tobacco; twelve were total abstainers from alcohol, twenty-two took little, eight drank moderately, one drank to excess on festive occasions, one was a free beer-drinker, and one "drank like a fish all his life" when he could, but said also that he could not get much. — *Boston Medical and Surgical Journal.*

SO-CALLED PURE VEGETABLE REMEDIES.

There is a curious superstition in the lay mind that all vegetable remedies are comparatively harmless, while mineral substances are much more injurious to the human economy. This superstition or prejudice in favor of t e vegetable kingdom is always skilfully appealed to by the quack, whether he be only an "Indian doctor," or represents the supreme development of charlatanism in the person of a "professor" who gives free lectures to the public on nervous debility, suborning the daily press for his purposes. The prejudice, perhaps, originated some fifty years ago, when the public and the profession began to realize that there was too much giving of antimony and mercury. It always received moral support from the old women, who only knew how to brew herbs, and feared what they did not understand. Besides, vegetable medication belongs to the childhood of the human race: the use of mineral drugs is the result of the acquirement of scientific knowledge and the general advance of civilization. It is no wonder, therefore, that it has been regarded with suspicion by the ignorant. But the fact is, the prejudice is entirely without foundation. At the present time a list of the poisons used as drugs will show a great preponderance of the vegetable kingdom. We have, for example, such universally consumed substances as alcohol, tea, coffee, and tobacco. These "purely vegetable substances" alone do a hundred-fold more to poison and deteriorate the human system than does the whole mineral pharmacopœia. But, besides these, we have opium, Indian hemp, and the whole seductive list of "purely vegetable" narcotics. By far the most powerful poisons to the system are of purely vegetable origin. Such, for example, is curarine, which produces its effects in doses of a hundred thousandth of a grain; and strophanthim, of which a solution containing one part to ten million of water will kill the exposed heart of the frog. The most subtle and evasive of poisons is the active principle of the "purely vegetable" digitalis purpurea, while strychnia has probably poisoned more animals and human beings than any drug but arsenic.

Take it as a rule, therefore, the most violent poisons, and the substances that produce the most deleterious effects on the human system, are from the vegetable kingdom. The mineral drugs which

may cause harm are few in number, and, if we except arsenic, are not especially violent poisons. There is a considerable amount of poisoning from lead, but not through its medicinal use; and the same may be said at the present time of mercury.

In fine, it is the purely vegetable drugs which are the most dangerous, because it is these which stimulate the brain or benumb the senses, induce morbid habits, and eventually establish physical degeneration.

We wish that the public could be made to understand this when it is confronted with alluring notices of the perfect safety and harmlessness of "purely vegetable" drugs. — *New York Medical Record.*

THE ARCHÆOLOGY OF ARTIFICIAL LIMBS.

The history of medicine is all but silent on orthopedic surgery. And yet the Greeks and Romans, who, as archæology has shown, had anticipated much of modern dentistry, cannot have been without artificial substitutes for limbs lost in the vicissitudes of peace or war. Herodotus tells us of a captive who amputated his foot to free himself from the shackle, and thus escaped to his friends, who replaced the limb by a wooden one. The elder Pliny records the case of M. Sergius, great-grandfather of Catiline, who lost his right hand in his second campaign, was wounded twenty-three times in two campaigns, and had the complete use of neither hand nor foot. Twice made prisoner by Hannibal, he twice escaped, after twenty months spent in chains. He fought four battles with his left hand only, and then made himself a hand of iron, which he fastened on to fight with; and, thus accoutred, raised the siege of Cremona, protected Placentia, and took twelve camps of the enemy in Gaul. Similar substitutes for amputated arms or legs must have been in use even before the time of Sergius; so, at least, we may infer from the treasure-trove turned up at Capua in 1885, in a tufa-grave. Among the contents of this tomb was an artificial leg made of bronze, wood, and iron; the skeleton being entire, save the bones represented by the artificial limb. This (probably unique) relic is now in the Museum of the Royal College of Surgeons of London, and is thus officially described: "Roman artificial leg. The artificial limb accurately represents the form of the leg. It is made with pieces of thin bronze, fastened by bronze nails to a wooden core. Two iron bars, having holes at their free ends, are attached to the upper extremity of the bronze. A quadrilateral piece of iron, found near the position of the foot, is thought to have given strength to it. There was no trace of the foot, and the wooden core had nearly all crumbled away. The skeleton had its waist surrounded by a belt of sheet-bronze, edged with small rivets, probably used to fasten a leather lining. Three painted vases (red figures on a black ground) lay at the feet of the skeleton. The vases belonged to a rather advanced period of the decline in art (about 300 B.C.)." Commenting on the above, Gen. H. H. Maxwell says, "It is important to add, from other sources, that the upper third of the leg was hollow, while the lower two-thirds were filled with wood." — *Lancet.*

WATER AS A DIURETIC.

Dr. L. Brunton, in a recent article, states that water is, perhaps, the most powerful diuretic we possess, although fewer experiments have been made with it upon animals than with the others. The diuretic action of water drank by a healthy man is very marked, and it appears impossible to explain its elimination by a mere increase in blood-pressure, whether general or local. It has the power of increasing tissue-change, and thus multiplying the products of tissue-waste which result from it; but it removes these waste products as fast as they are formed, and thus, by giving rise to increased appetite, provides fresh nutriment for the tissues, and acts as a true tonic. In persons who are accustomed to take too little water, the products of tissue-waste may be formed faster than they are removed, and, thus accumulating, may give rise to disease. Many gouty persons are accustomed to take little or no water, except in the form of a small cup of tea or coffee daily, besides what they get in the form of wine or beer. A large tumbler of water drank every morning, and especially with the addition of some nitrate or carbonate of potassium, will prevent a gouty paroxysm.

Still more numerous, possibly, is the class of people who rise in the morning feeling weak and languid. Many such people are well fed, they sleep soundly, and it seems almost impossible to believe that the fatigue which they feel in the morning can result from imperfect nutrition, more especially as one finds, that, after moving about, the languor to a great extent appears to pass off. It seems that this languor must depend upon the imperfect removal of the waste products from the body, as we know that the secretion of urine in healthy persons is generally much less during the night than during the day. Such people should drink a tumbler of water before going to bed, in order to aid the secretion of urine and of waste products during the night. — *Practitioner.*

MEDICAL MEMORANDA.

Anæsthetics. — The history of anæsthetics is a most remarkable illustration of how long we may be on the very verge of a most important discovery. Ether, which, as we all know, produces perfect insensibility to pain, was discovered as long ago as 1540. The anæsthetic property of nitrous oxide, now so extensively used, was observed in 1800 by Sir H. Davy, who actually experimented on himself, and had one of his teeth painlessly extracted when under its influence. He even suggests, that, "as nitrous oxide gas seems capable of destroying pain, it could probably be used with advantage in surgical operations." Nay, this property of nitrous oxide was habitually explained and illustrated in the chemical lectures given in hospitals, and yet for fifty years the gas was never used in actual operations.

To Abort a Felon. — Dr. Edward T. Williams thus writes to the Boston *Medical and Surgical Journal:* "Some one asked how to abort a felon. I will tell him how I have aborted a great many, though of course this cannot be done except in the earliest stage. Tie a rag loosely around the finger, and keep it constantly wet with cold water. It cures often; but probably some more fantastic appliance will better please most patients, and give them a higher opinion of the surgeon's skill."

Exemption from Pulmonary Diseases in Germany. — Dr. Rush declares his conviction that the German people are largely indebted for their exemption from pulmonary diseases to the strength and volume which their lungs acquire in the practice of vocal music, which is well-nigh universal among the people, extending from childhood to old age. He thinks the education of the voice, and practice of singing, involving, as it does, the proper exercise of the organs of the throat and the lungs, should form a part of our physical education.

Boracic Acid in Fetid Perspiration. — Dr. Shoemaker (*Med. Bull.*) recommends a dram of boracic acid to the ounce of wool-fat in oily skin, fetid perspiration, etc.

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The Tyer Rubber Company advertise a syringe especially adapted to the wants of physicians. It is supplied with a variety of hard rubber tubes suitable for all the various uses required of such an instrument, and is sold at a moderate price.

The spring is usually selected as the best time to remodel and repair houses. It is also the best time to provide them with Jackson's Heating and Ventilating Grates, an addition which will be highly appreciated in the chilly days of late spring and early summer, after the furnace fires have been discontinued.

Horsford's Acid Phosphate acts as a tonic for the stomach and nervous system. Its specific use is to relieve irritation of the bladder, prostate, testes, and urethra, and to improve the nutrition of the nervous system. Its use is also indicated in all pains and inflammations. Wherever the nervous system is necessitated to spend its force and energy, the true remedy is acid phosphate. The greater the wear and tear, the more necessary is it to supply nerve-food. It is a remedy of the highest value in dyspepsia, sick-headache, mental and physical exhaustion, nervousness, diminished vitality, neuralgia, and debility in nursing-women. Physicians have used it with unqualified satisfaction. The utmost reliance can be placed upon it, for it is without an equal in the treatment of all nervous diseases.

The Popular Science News

AND

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CONTENTS.

FAMILIAR SCIENCE. — International Co-operation in Meteorological Science 49
Some Remarkable Atmospheric Phenomena 51
Simple Physical Experiments 51
Natural History Notes 52
Scientific Brevities 53
PRACTICAL CHEMISTRY AND THE ARTS. — An Incandescent Gas-Lamp 53
Antidotes for Poisonous Chemicals 53
The Inventor of Saccharine 53
Exhibition of Lighting-Apparatus 53
The Salt Mountain of Palestine 54
Making Hard Wood out of Soft 54
Thermometer for Lecture Experiments 54
Railroad Notes 54
Industrial Memoranda 54
HOME, FARM, AND GARDEN. — The Chemistry of the Laundry 55
The Mysteries of Plant-Growth 55
A Plant of Great Antiquity 56
EDITORIAL. — The Earthquake in France 58
Astronomical Phenomena for April, 1887 58
Meteorology for February, 1887, with Review of the Past Winter 58
Questions and Answers 59
Literary Notes 59
MEDICINE AND PHARMACY. — Some Facts concerning the Human Brain and Mental Phenomena 60
Hygienic Errors 60
Exercise and Recuperation 61
Monthly Summary of Medical Progress 61
A Remarkable Recovery from a Wound in the Head 62
PUBLISHERS' COLUMN 62

Familiar Science.

[Written for the *Science News*.]

INTERNATIONAL CO-OPERATION IN METEOROLOGICAL SCIENCE.

BY PROFESSOR N. S. SHALER.

THE present seems a favorable time for considering the future of meteorological science, or at least of that part of the science which necessarily involves the continuous labor of many observers, and therefore is best accomplished through the aid of governments. The people of this country have evidently become very much interested in the system of weather predictions; they have maintained and extended the federal signal-service, although the methods of its work have been in many ways unsatisfactory. Several of the States have created local meteorological bureaus, in order to secure a more detailed consideration of their storms. At present there is a spontaneous movement to separate the signal-service, as far as that service has to do with weather-foretelling, from the army, in order that it may escape the serious dangers of military control. Although this service has doubtless greatly profited from the organizing power of the department in which it originated, it is clear that the motives of a military organization are opposed to the best development of its system. Those methods are necessarily rigid and formal. They allow only obedience to constituted authority; they derive their peculiar value from that unquestioning and unsuggestive obedience which the soldier learns to yield to those who are set over him. Every impulse must come down from above. The individual must be a machine; intelligent, it is true, but acting with mechanical certainty. This is an impossible system in a scientific corps which has for its first function to extend the bounds of knowledge in a domain where advance is imperatively needed.

With the change in the conditions of the signal-service, we may hope to have the element of progress and inquiry a more prominent feature in its work than it has been hitherto. I propose to consider one of the conditions of advance in the meteorological work of this government which seems to me well worth discussing. This is the co-operation of its work with that of other countries. So far, the meteorological work done by the governments on this continent and Europe has been carried on without any real unity of plan. The observers on either side of the Atlantic have in the main dealt with their own problems as if they were entirely isolated phenomena.

It is evident that predictive meteorology demands a greater unity of action on the part of the government bureaus which have the matter in hand than any other branch of public service, except, it may be, sanitary medicine. Geological science, for instance, can be carried on on the continents on either side of the Atlantic in a somewhat separate manner. Even astronomy, when the subject-matter is identical, can be pursued in several different countries without accord, with merely the risk of a certain deflection of results, which is not without advantage to the science.

In the science of meteorology, especially when that science is to be made the basis of weather-foretelling, the conditions demand a wider field of observation than is afforded by any one continent. The envelope of the atmosphere is so sensitive, and it propagates its disturbances so far, that any local observations do not seem to give the basis for the study of climatic changes of the larger sort. Such studies must include the whole field of atmospheric variations. The field of the United States is, perhaps, wide enough to afford the means of predicting the greater part of the changes which come about within the limits of three or four days; but these brief forecasts, though they have been of value to the public, we must not accept as the full measure of benefit which meteorological science can give us. We need forecasts which will give the general conditions of the weather for much longer periods of time. The chance of success of such an effort to secure a wider field clearly depends upon a broader range of knowledge than we now have.

The precise limits of the areas over which it will be necessary to extend a co-operative study of climatology will, to a great extent, have to be determined by practical trial: but it is tolerably clear that the North-Atlantic basin, and the lands which surround it, so far form what we may term a meteorological unit, that it needs to be studied in a co-operative way; that is, the climatal conditions of one part of this field may not infrequently be propagated to other parts of it. The temperature and the original rainfall of this district — i.e., the precipitation derived from the sea — is to a great extent determined by the conditions of the North Atlantic Ocean. It is, for instance, most likely that the heat-volume and rate of flow of the Gulf Stream, and the precise path of its waters, from year to year, are subject to certain variations, and that these variations extend their effects to the continents on either side of the Atlantic Ocean. As the source of the Gulf Stream is within the tropics, it is clear, that, as far as the conditions of that ocean have to be determined, they must be sought in the equatorial belt. Furthermore, as Dr. James Croll has well shown, the proportion of the waters going to form the Gulf Stream which are turned into the northern hemisphere, is determined by the relative energy of the trade-winds in the Northern and Southern Atlantic basins. Therefore, even if we should endeavor to limit the studies of climate to the phenomena of the North-Atlantic basin, we would be drawn to study, in part at least, the climatal conditions of both hemispheres.

It may at first sight seem speculative to consider the study of the Gulf Stream and the other determining conditions of the North Atlantic as of sufficient importance to warrant an international effort to carry it out; but, when we note the profound effect of the tropical heat brought into the North Atlantic by this stream, it becomes clear that there is a real need of such inquiries. The positions of the isothermals, as well as the lines of equal rainfall, on the lands about the North Atlantic, are very greatly affected by the action of this stream. Dr. Croll has shown that probably more heat comes to the earth's surface within the arctic circle by means of this current than from the direct rays of the sun. We cannot escape the conclusion, that, in so far as this stream varies in volume, temperature, or velocity, it cannot be without effect on the climate of the neighboring lands. So, too, in a less but still important degree, the secondary currents, which carry the polar waters southward, must, by their variations, affect the climate of the North-Atlantic district. The energy of these currents is one of the causes

which determine the southward movement of the polar icebergs, as well as of the body of cold water which they bring down the eastern shore of North America. The temperature of this sea in good part determines that of the winds which blow from it to the land, and the share of moisture which they carry to the continents. It is probable that it has its effect in producing the equation between the centres of barometric pressure which determine the movements of the atmosphere. In a similar but perhaps less important way, the Pacific equivalent of the Gulf Stream affects the western portion of this continent. Little is known of this Japan current. Its volume is not accurately determined, and of its rate of flow we know comparatively little.

Besides these oceanic problems, there are many questions of extreme importance to predictive meteorology which need coincident work in many separated regions. First among these we may place the problem of the variations in the sun's heat.

As the whole of the activities of the earth's surface depend upon the energy which comes to it from the celestial bodies, and in by far the larger part from the sun, any variation in the amount of that energy is of the utmost importance to us. There is good reason to believe that the solar radiation varies from period to period, but the amount of this variation is unknown; nor do we know the proportion of variation in the actinic and the heat element of its rays. We are equally ignorant of the effects arising from such changes. There are probably variations in the total amount of the heat received from the sun, due to the extent to which the clouds enwrap the earth in different years. We can see that there is a great field for future inquiry, which may serve to give us data on which to forecast, at least in general terms, the conditions of climate in a far better way than is possible at present. To attain to any thing like the knowledge necessary to give us the basis for more extended forecasts than those now secured, it will probably be found necessary to study the climatology of the earth as a whole; at least, it will be necessary to select for observation those features, in regions remote from the North Atlantic, which can have influence on its conditions. It is not likely that we can determine what is of importance to the climates of Europe and America without a pretty thorough study of all the great climatal units of the earth.

There are six great nations which would naturally be members of a meteorological union. These are Great Britain, the United States, France, Germany, Russia, and Spain. Perhaps Holland could advantageously be added. These countries and their colonies occupy the earth in such a position that there would be no very great area of land or sea, except the polar regions and the central areas of the oceans, which would be quite unobserved, in case each organized an efficient system of observations. It may be said that the present system of meteorological records seems to give meteorological data from the most of these countries. This is, in a measure, true; but the stations where the observations are made, and the method of the observations themselves, as well as the subsequent study of them, are not adjusted to the requirements of the work which is needed. Moreover, the central parts of the oceanic regions are left without observations, except those which may by made by the passing ships. Imperfect as these are, they have proved of very great value to the science of meteorology; but they need to be supplemented by systematic studies carried on by observers on suitably appointed ships, which shall continuously cruise in the given district. Many of the most critical parts in the climatal machinery of the oceans are left for years without careful observations. Among these we may note the parts of the Gulf Stream where it flows between Cuba and Florida, and the neighboring part of the Stream which passes to the northward and eastward of the Antilles. This portion of the Gulf Stream lies very near the naval station of Key West; and from that point, with comparatively little expense, the well-trained officers of our navy could easily make a detailed and continuous study of this most important artery of the Atlantic's circulation. In the course of ten or twenty years we might hope, from such studies, to ascertain the variations, if such there be, in the flow of this great tide of warm water. The corresponding variations in the climate of the regions about the North Atlantic might then show us how far those regions are affected by the changes in this source of heat and rainfall. An even more promising source of determinations may be found in the temperature conditions of the region within the arctic circle. Unfortunately, there is no civilized district within that region, or at least within the zone of its characteristic conditions; but it is not beyond belief that the spirit which has sacrificed so many lives and so much money in efforts to determine the geography of the polar sea, may be turned to the more sensible end of furnishing permanent stations in high latitudes, connected with the inhabited world by telegraphic communication.

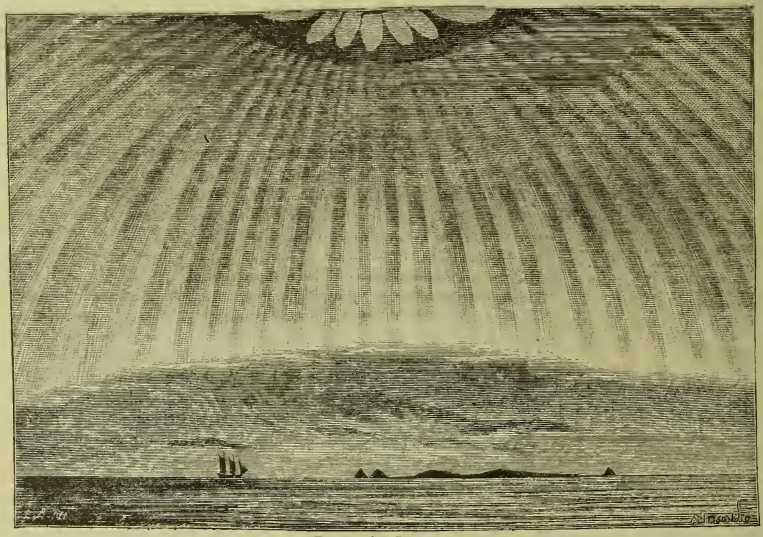

Fig. 1. — See Page 51.

Besides the work of meteorological studies, which would be the principal task of an international Board, there are certain other inquiries which might fairly come within its province, or at least could be carried on without prejudice to its main objects. First among these we may reckon observations on the movements of the earth's crust, — not only earthquakes, but those lesser oscillations known as earth-tremors. There is the more reason for including these movements among the matters to be studied by meteorologists, since it appears that in certain cases they are caused by variations in the barometric pressure of the district in which they occur. There is reason to hope, that, by systematic observation in this class of phenomena, we may in time find our way to predict the occurrence of shocks of greater violence. To determine this point, we need a series of observations long continued, and carried on at a great number of places in different parts of the world. It is not impossible that this system of international observatories might be, to a certain extent, advantageously combined with the work of an international medical corps, devoted to the study of migratory diseases. There is great need of such observations in tracing the movements of maladies such as

cholera and yellow-fever. Medical officers, having the peculiar independence which they would secure in such an organization, would give much more trustworthy information as to the march of epidemics, than can now be secured.

The practical difficulties in securing effective co-operation between several governments are certainly great. It is, at the outset, evident that the corps of the several States would have to remain in a way separate, each dependent on the control of their several governments. But there might be a commission composed of a

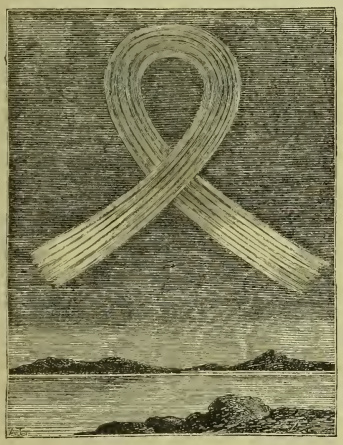

Fig. 2.

few men, delegates from the several authorities, to which would fall the task of combining the results obtained by the separate corps. There have been a number of commissions, and other forms of association, organized for special duties, which show that international co-operation in scientific work is not impossible. Much remains to be done in training separate governments to act in concert in matters which concern all men. The power of co-ordinated endeavor, so well developed in the individuals of every civilized State, needs to be extended to the larger individualities of nations. There is no other field in which this beneficent work can so well be begun as in this matter of predictive climatology, for it alone among the sciences appeals directly to the interests of governments and individuals alike; while, at the same time, it demands a range of knowledge not obtainable in any one country.

To secure such co-operation, we need to have our own bureau on a civil basis. The co-operation of a military establishment in this country with civilian organizations in foreign parts seems impossible. Armies are for war, and cannot be expected to lend themselves to the utterly unwarlike business of studying the problems of climatology.

M. A. Bulle, of Besançon, France, has effected the direct electro-chemical deposition of palladium on iron, steel, and other metals. The deposition is made directly and of any required thickness.

SOME REMARKABLE ATMOSPHERIC PHENOMENA.

The elder Pliny, in his great work on natural history, has much to say about wonderful signs and portents in the heavens. He speaks of "many suns" and "many moons" being seen at once, and fiery shields, and spears, and armed bodies of men rushing across the sky, to the great terror of the superstitious Romans.

These phenomena were doubtless due to unusually brilliant meteors or auroras; and although they can now be partially explained by natural laws, yet, as to the actual cause of auroras at least, we know but little more than the old Romans.

When we have said that the aurora is an electrical phenomenon, and caused by a discharge of electricity in the rarefied air of the upper atmosphere, we have about reached the end of our knowledge. What causes the discharge, or the laws which govern it, are still unknown to us; and although we are sure of its harmless nature, yet it is impossible to avoid some feeling of awe when the northern heavens are lighted up as by a celestial conflagration, or become "as red as blood."

In this latitude the aurora is rarely seen in its perfection, but nearer the north pole it often presents a spectacle of wonderful beauty. We reproduce from *La Nature* some illustrations of auroras observed by M. Lemström in Lapland. Fig. 1 represents an aurora observed by him on Oct. 18, 1868. Necessarily, only half the horizon is figured in the illustration; but the entire sky was filled with the light. It is thus described by M. Lemström: "Suddenly the phenomena embraced the entire horizon. Everywhere were flames and rushing streams of light; yellow below, green in the middle, and reddish violet at the upper extremity. In an instant all the rays reunited at the zenith into a regular crown of dazzling light, and covered the sky from the southern

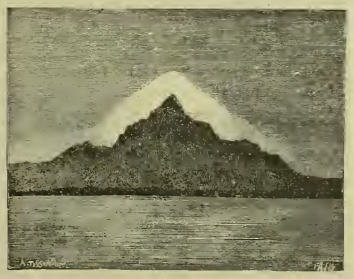

Fig. 3.

horizon to the zenith. When the phenomenon was at its greatest intensity, it had the effect of an immense vaulted temple lighted at the top by a brilliant chandelier." This magnificent exhibition lasted but a few minutes, but a considerable time elapsed before the light entirely disappeared.

Fig. 2 represents a remarkable form of aurora observed in the same country in 1871. The lower part was of a yellow color, and the curved rays were red, violet, and blue. It was first seen to form upon the horizon, and gradually rise into the air.

Fig. 3 shows a luminous appearance, resembling the aurora resting upon the summit of a mountain. Examined by the spectroscope, it was proved to be of the same nature as the auroras seen in the heavens. M. Lemström observed similar appearances upon the roofs of houses, upon the snow on the ground, and upon the ice-covered surface of a lake; thus showing that the phenomenon is not entirely confined to the upper regions of the air. Simi-

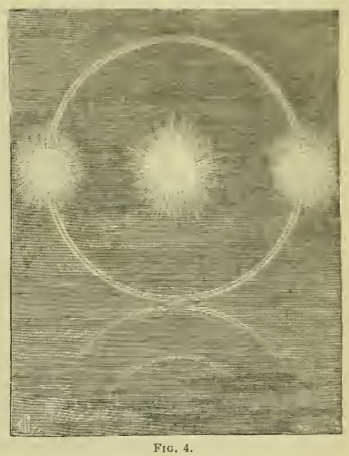

Fig. 4.

lar appearances have been observed among the Alps, the Andes, and the mountains of Mexico, and are all, probably, different manifestations of the same phenomenon.

The appearance of *parhelia*, or mock suns, is not very common, though the halo, or "storm-circle," about the moon, is of very frequent occurrence. They are probably caused by the reflection and refraction of the light by minute crystals of ice in the upper regions of the atmosphere, and, as an indication of an excess of moisture in the air, may not infrequently foretell a storm. The condition of the atmosphere in France on the 28th of January was apparently very favorable for the production of this phenomenon, and the illustration (Fig. 4) shows the appearance of the sun at the town of Souppes. Similar appearances were observed in many other parts of France, and it is quite unusual to have the conditions so favorable for the occurrence of the phenomena.

SIMPLE PHYSICAL EXPERIMENTS.

The expansion of metals by heat is usually shown by means of a pyrometer usually more or less complicated and expensive. A correspondent of the English Journal *Nature* describes an ingenious and simple apparatus, which can be easily made by any one, and readily indicates the expansion by heat of a bar of metal or any other substance in a few seconds.

A small flat rod of the substance to be

examined, about one foot in length, is laid upon two blocks. A weight is placed upon one end, to keep it from moving; and the opposite end rests upon a fine sewing-needle laid at right angles to the bar. To one end of the needle is attached a pointer consisting of a stiff straw eight or nine inches long, which moves in front of a screen of white cardboard attached to the block. One or two shot, held in the short end of the straw with a little sealing-wax, serve to balance the longer and heavier end.

When the rod is heated by a lamp-flame, the free end, as it expands, moves forward

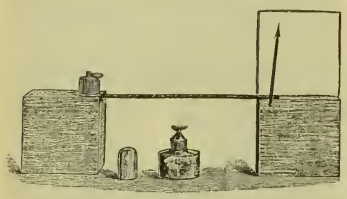

Fig. 1.

upon the needle, and rolls it around; its movement being shown by the motion of the pointer. Even the slight expansion of a slip of glass is thus easily rendered evident to a class. By placing two bars of different materials, each provided with its own pointer, side by side, and heating them with the same flame, the difference in the rate of expansion between them is plainly shown. In such a case, it is, of course, necessary to have each bar rest upon the same-sized needles.

If a moving force is suddenly applied to a body, an appreciable interval of time intervenes before it takes up the motion, and commences itself to move. The length of time varies with the weight of the object and the

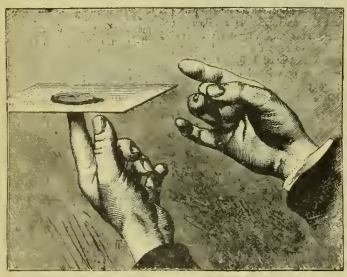

Fig. 2.

strength of the force applied to it. This property is known as *inertia*, and can be shown by placing a coin upon a visiting-card, and balancing it upon the finger. By sharply snapping the card with the thumb and finger, it will be struck away from the coin before the motion can act upon it; leaving it resting alone on the tip of the finger. The blow must be sharp and quick, or the experiment will fail. Another illustration of the same principle can be given by placing several newspapers upon a table, and attempting to remove the one at the bottom. If it is slowly pulled, the whole pile will come with it; but if it is quickly snatched away, the papers above it will remain in position, owing to the time required for the motion to be transmitted throughout the entire pile.

Another experiment of this class is performed as follows: Into the ends of a rod of wood — an old broomstick will answer — stick two needles. Place two glass tumblers on two chairs, and support the stick between them; the needles resting on the edge of the glasses. Now, if the stick be struck a quick, heavy blow in the middle with a poker, or any heavy iron implement, it will be broken in two without injuring the glasses or breaking the needles. In this case the inertia of the mass of the stick is such that it is crushed at the point struck before the motion can be transmitted to the ends. Unless the blow is very sharp and heavy, the experiment will fail; and it might be well at first to substitute for the glass tumblers some support of less value.

NATURAL HISTORY NOTES.

BY DR. S. F. LANDREY.

IV.

The large moth, with a spread of wings of six inches, and four large eyes, or spots on the wings, known to naturalists as Saturnia, is comparatively harmless in the butterfly stage of growth. Its larvæ, however, are very destructive to apple-trees and other garden-fruits by eating up the leaves, and imbibing their juices. My youngest son, attracted by the unusual size and spots of a female, caught her, and brought her to me. She was placed in an empty canary-cage, and hung out in an apple-tree. I knew there would be a war of suitors that night. Next morning *eleven* dead and maimed ones lay under the tree; eight of these were fair specimens, and were pinned to the drying-board. The next night a male effected an entrance into the cage, but succeeded in escaping next day. The next night he was caught again; this time the cage was removed to the curiosity-room. On examining the cage, dozens of the eggs were found adhering to the wires. Many were sticking to the window-panes. Altogether, one hundred and nineteen eggs were found. These were put in a clean wide-mouthed bottle, and a piece of wire cloth bent and fitted over it. In eleven days they all hatched out; and such a collection of creeping, moving, spiny, warty, little black worms is seldom seen. A female caught the year before, and placed in the same room, laid seventy-five eggs, which hatched out in exactly fourteen days. She fluttered and flew around as if hunting a suitable place. Alighting on a cardboard, I noticed her body bend beneath it. After she flew off, I examined it underneath; and there, with a brownish glue, she had stuck a dozen or more eggs. Next morning her work was done, and the eggs gathered and put into a bottle, where they hatched out in a fortnight. The male antennæ are three-quarters of an inch long and three-eighths of an inch wide, while the female antennæ are only five-sixteenths of an inch long and a quarter of an inch wide. Their ovulation and journeys occur both at night and in the day-time. The eggs are the prettiest little oval balls ever seen, about two lines long and a line and a half thick, of a muddy or dusky white color. The little tenant cuts a small circular hole, exactly round, as if done with a compass, and, as he emerges, often leaves the piece cut out hanging by a thread or edge, like a tiny trap-door. The hole is always at or near one end. His knife must be delicate, for, on turning the lid back to its original site, it would require sharp eyes to detect the line of demarcation between them. The larvæ are, of course, egg-size. They appear larger, for their spines are erect; while in the eggs they are pressed to the body.

A woman and her daughter, hearing a chicken cry, and, on looking out, seeing a tumult of some kind in the chicken-yard, supposed a hawk must be among them. They ran out to their assistance, when they perceived a weasel holding a hen in his mouth, and struggling for the mastery. They picked up a stick apiece, and gave chase. The weasel let go his hold on the chicken, and attacked the women; it was now their time to scream, and they called for help loud enough to alarm the man of the family. On *his* approach, the weasel made good his escape. Did the weasel realize or know that the man would prove a more formidable enemy than the women? He certainly must have reasoned that in the man was more courage, strength, and destructive nature than the two women possessed, or he would not have given up the conflict in so needy a time.

In the Wabash-river Bottoms near Terre Haute, some years ago, my brother and another man saw in the path before them a pair of male and female blue-tailed lizards (*Eumeces fasciatus*). Impulsively, and without much thought about it, they killed the female. All at once lizards seemed to become unusually numerous: wherever they turned, one appeared. A closer observation revealed the fact that it was the male following them. This continued for over half an hour. When they reached the water, they lost sight of him, and crossed over, and camped on the opposite side; while at work, their lizard reappeared. The fact now impressed their minds that his motive was one of revenge. What the little fellow might or could do, they knew not, but thought it best to kill him too, to get rid of his persistent attentions to their movements. Was it grief for his loss, with an expectation that they would restore the life so wantonly taken? or was it a desire for revenge? If so, what would have been his method?

A neighbor's cow had become troublesome, breaking into my newly made garden every night or two. Cow-tracks were in the yard; the garden-beds were full of them. I remonstrated with my neighbor. He promised immediate attention. Next evening the cow appeared at the gate. A formidable series of telegraph wires adorned her horns. She tried to reach the hook on the inside, and seemed to fail; but, on going out in the morning, there she was again. Several devices were tried; but her motto was "Perseverantia omnia vincit," and she would inevitably succeed in one way or another. An apple-tree bough overhung the sidewalk, about six feet high. This she would reach by standing on her hind feet, — rising quickly, — and seizing the branches in her mouth. The shaking given them on returning to her normal position never failed to shake off enough apples to satisfy any cow needing dessert at the end of a meal. He sold her.

A turkey was feeding by the roadside not far from a farmhouse. Near him was a broken and dead tree-trunk, on which a crow lighted, and was looking at the turkey enjoying his meal. The crow soon exhibited a desire to partake of the same food, and alighted near the turkey. A strut, spread, and semi-rotation of the tail, and thundering with the wings, followed on the part of the turkey. He dashed at the crow; but the latter dodged, went over

the former's back, and alighted on the other side. This was repeated over and over again, proving to the turkey that the crow's strategies were more than his own skill could overcome. At first his rage was uncontrollable; but, finding he was defeated, he at length, willing or unwilling, let the crow finish his meal. I stood still, to see how the conflict would end, till I became convinced that a crow's cunning and agility are more than a match for a turkey's size.

"Limber Jim," as the boys used to name him, was the worst piece of furniture ever owned by anybody. He would shy and overturn the buggy, or kick and run for a mile, without the least compunction of conscience or fear of the horse-hades. Worst of all, he liked tobacco, and would sometimes put on Sunday manners for a whole day if he got all the tobacco he wanted, in the morning before driving out. To take a chew in his presence without offering him a "bite" was to see a picture. He would raise and lower his head, shake it, extend his nose, and work his lips, then "lay back" his ears, and paw with his fore feet. If this did not bring tobacco, he would bite at the chewer till he obtained what he desired. Another horse I knew, owned by a hard drinker, would drink whiskey. His owner would go forward a hundred yards or more, and hold up a well-filled bottle; the horse would run to him, and drink a pint if it were given him.

Erratum. — By a slip of the pen, the corolla of the *Lobelia spicata*, mentioned in the "Notes" in the February number, was described as having a length of four *inches*, when four *lines* was the measurement intended.

SCIENTIFIC BREVITIES.

Electric Lamp. — Dr. Fleming says an incandescent lamp is not only a useful thing, but it has about it many points of great interest in physics. Many persons have the impression that the interior of a glow-lamp was a place that was empty of all air-particles, but this was not the case; it was as full as it well could be. Maxwell has shown, that, in a small cube of $\frac{1}{100000}$ of an inch, there would be found 100,000,000 molecules of ordinary air; so that, in a cubic inch of air, there were a number of molecules represented by 100,000,000,000,000,000. In a Swan lamp, when exhausted to one-millionth of an atmosphere, there remained some 100,000,000,000 molecules of air. As it took about ten days to count a million, a simple calculation would show that to count the number of molecules in such a vacuum would take 120,000 years of continual counting. — *Scientific American.*

Silver in Volcanic Ashes. — J. W. Mallett has found traces of silver in the ashes from an eruption of the volcano Cotopaxi, to the extent of two-fifths of an ounce to the ton. Lead, which was said to be present in the ashes of a previous eruption, was not noticed.

How the Sun puts out the Fire. — A correspondent of an exchange says: "If a small room has a large window facing the west or south-west, it is found that the afternoon sun puts out the fire, especially in spring, when the sky is clear and the sun is low. The reason is, that at this time of the day the fire is often allowed to get dull, and the sun's rays warm and rarefy the air in the room as much as the fire warms the air passing over it up the chimney. Hence the draught ceases, and the fire goes out. To remedy the inconvenience, open the door or the window, to let warm air out, and cold in.

Magnet. — In one of the French schools there is a natural magnet which is capable of lifting four times its own weight.

Practical Chemistry and the Arts.

AN INCANDESCENT GAS-LAMP.

A novel lamp, which seems to combine in a measure the advantages of both gas and electricity, was invented some months ago by Dr. Auer von Welsbach of Vienna. Its construction is very simple, consisting of a common Bunsen gas-lamp, in which is burnt a mixture of gas and air. This produces a very hot non-luminous flame; but, by introducing into it a sort of network of mineral matter, it become incandescent, giving a bluish-white light, which is perfectly steady, and free from smoke.

The composition of this incandescent network is in part a secret; but the inventor claims that it is prepared by soaking a piece of coarsely woven cloth in a solution of the salts of zirconium, lanthanum, and yttrium. When this cloth is exposed to the flame, all the organic matter is consumed; leaving the oxides of the above-mentioned metals, which preserve the original form of the cloth. These, when heated, shine with a brilliant light, similar to the familiar calcium light, though less powerful.

The network tubes — or hoods, as the inventor calls them, only cost about a cent apiece, and will last for a thousand hours. It is claimed that the amount of gas burned is diminished one-half, with the same light-giving power; but practical trials will be needed to determine this. If the composition of the incandescent "hoods" has been given correctly by the inventor, an important practical use will have been found for some rather rare metals, which have hitherto been only of theoretical interest.

ANTIDOTES FOR POISONOUS CHEMICALS.

Many serious accidents, says the *Moniteur des Produits Chimiques*, happen or may happen in consequence of a loss of time in the application of remedies in the case of poisoning by such poisonous chemical products as are commonly employed in the industries. The following antidotes are recommended: For phenic, sulphuric, muriatic, nitric, or nitro-muriatic acids, creosote, tincture of iodine, or phosphorus, use the white of an egg well beaten up in water, and a teaspoonful of mustard in warm water. In case sulphuric, nitric, or muriatic acid has been swallowed, it is necessary to take lime mixed with as small a quantity of water as possible.

For chromic acid, the chromates, and colors that have chromium for a base, the compounds of copper, and such preparations as have antimony for a base (such as tartar-emetic), and the compounds of mercury and zinc, use the whites of eggs in abundance, and, as an emetic, mustard, which, however, is useless if the poisoning has been done by tartar-emetic.

For ammonia, soda, potassa, the silicates, and the alkaline hydrosulphates, use vinegar, and afterward oil or milk.

For prussic acid and its salts, the cyanides of potassium and mercury, the sulphocyanides, oil of bitter almonds, or nitrobenzine, pour water on the patient's head or spinal column, and put mustard plasters on the sole of the feet and the stomach. Do not let the patient go to sleep.

For ether, petroleum, benzole, fruit essences, and concentrated alcohol, take strong mustard as an emetic, with much warm water, cold baths, and fresh air. Keep the patient awake.

For the compounds of baryta or lead, use mustard as emetic, with warm water, Epsom salts or Glauber's salts in water.

For arsenic and its compounds, use mustard, and dialyzed iron with magnesia, and afterward oil, milk, or mucilaginous liquids.

For oxalic acid and its salts, use lime or lime-water, and afterward castor-oil.

For nitrate of silver, use kitchen salt dissolved in water, and mustard as an emetic.

For the nitrous fumes from the manufacture of nitrate of iron or of sulphuric acid, take acetic acid as strong as can be endured, in small quantities at a time. — *Scientific American.*

THE INVENTOR OF SACCHARINE.

Professor Ira Remsen, in a letter to the New-York *Times*, says: "The substance which has come into prominence of late under the name 'saccharine' was discovered in the laboratory of the Johns Hopkins University under the following circumstances: Fahlberg was working here about six or seven years ago as an advanced student. At his request, I assigned a problem to him for original investigation. This investigation he afterward carried on under my guidance. When the work was completed, I wrote an article giving an account of the results obtained, and published it in the *Report of the German Chemical Society*, placing Fahlberg's name with mine at the head of the article. Afterward I published a fuller account of the investigation in the *American Chemical Journal*, again crediting Fahlberg with his share of the work by placing his name with mine at the head of the article. In other articles the now famous sweet substance known as benzoic sulphiuide was fully described, and its marked sweetness commeuted upon. Soon after this, Fahlberg left the laboratory, and, as now appears, has occupied himself to some extent with the further investigation of the sulphiuide. This he did without consulting me. He has also taken out patents covering the methods of preparation which we first made use of here, and has not consulted with me in regard to this. In all his statements regarding the substance in question, he strives to make the impression that the discovery is his; and in most references to it in print he is given sole credit. I think it is time that I protest in the interest of truth and justice. Fahlberg carried out my directions, and deserves credit for this, and for this aloue. He did not make the discovery, and would never have made it if he had been left to his own resources. I have nothing to say regarding the probable success of this 'new industry' (?) save this, that I do not believe that the substance can yet be made cheaply enough to make it a successful rival of sugar. It is possible that the time may come when this can be done, but it is probably far distant."

EXHIBITION OF LIGHTING-APPARATUS.

At a lecture recently delivered before the students of Boston University, there were exhibited, accordiug to the press reports, the Persian pastilles of saturated sandstone, looking like cigars in candlesticks; the hollow soapstone filled with lard and wick, to give light in arctic lands, where half a year is wrapped in dusk; the tiny pyx lamps, worn in the belts of monks during their midnight vigils, centuries ago; the skulls of animals, which formed the designs for lamps in ruder ages; the gorgeous ecclesiastical candlestick; Florentine blendings of art and utility; quaint-looking lamps, that served

the fathers and mothers of New England in colonial days; and the whale-oil and naphtha lamps, beside which the good wives for generations did the family needlework and spinning. There, also, stood that modest object, the sperm candle, which is still looked up to as the unit of estimate in photometric work; the wax candle, which holds yet a high place on the altar and in the home; and all the modern devices of the arc and incandescent appliances of electricity which have come to us like a luminous progeny from the brains of Davy and Faraday.

"If you were to ask me," said the lecturer, as he touched a tiny earthen lamp with a rude wick hanging from it, "If you were to ask me who lit this lamp last, I think I could hardly tell you, because it was last used in the buried city of Pompeii, two thousand years ago."

THE SALT MOUNTAIN OF PALESTINE.

Palestine possesses a remarkable salt mountain situated at the south end of the Dead Sea. The length of the ridge is six miles, with an average width of three-quarters of a mile, and the height is not far from six hundred feet. There are places where the overlying earthy deposits are many feet in thickness; but the mass of the mountain is composed of solid rock-salt, some of which is as clear as crystal. How far this deposit of salt extends below the surface of the ground, no one at present knows. At some points, this ridge, which is on the shore of the Dead Sea, approaches very closely to the water; and at others it recedes, until it is fifty or more yards from it. Just here the water of the Dead Sea is much more salt than it is at the north end, where the Jordan enters the lake. This salt is a government monopoly. The same is true of the salt that is contained in solution in the Dead Sea itself. If Arabs or the natives of the country were found getting salt from the shores of the Dead Sea or from this salt mountain, they would be arrested at once. Most of the salt used in Hebron, Jerusalem, and elsewhere in this part of Palestine, comes from these sources; but it is gathered under the direction of government officers, and the revenue is supposed to go to the government. — *American Rural Home.*

MAKING HARD WOOD OUT OF SOFT.

The London *Engineer* says: "For the manufacture of loom-shuttles, boxwood has hitherto been very largely used; but the price has become almost prohibitive: and it has been found, that, by the compression of cheaper classes of wood, a substitute meeting all requirements can be obtained. For carrying out this process, Sir Joseph Whitworth & Co., of Manchester, England, have recently completed a powerful hydraulic press to be used in compressing wood for loom-shuttles. This press consists of a strong cast-iron top and bottom, with four steel columns and steel cylinder, with a large ram. In the centre of this ram is fitted a smaller ram, fitting into a die, which is placed on the top of the large ram. The wood is put into this die, and a pressure of fourteen tons per square inch is applied. The top pressure block which fits the die is then removed; and the small ram, rising, pushes the wood out at the top of the die."

The same exchange adds: "The wood thus treated is made very dense and uniform, and so close-grained that it is capable of taking a very high finish. For the manufacture of shuttles it has been found as good as boxwood, and there is no doubt that a similar process might be applied with advantage to other branches of industry where expensive hard woods have now to be used."

THERMOMETER FOR LECTURE EXPERIMENTS.

F. C. G. Müller describes a thermometer which can be read at a distance of twenty-five feet, in the following manner. The liquid used is concentrated sulphuric acid blackened by the addition of a little sugar. This liquid expands uniformly, and has three and a half times the coefficient of expansion of mercury. The thermometer is made in the ordinary form, the scale being drawn on a strip of card. The scale just below and above 0°, 100°, and 200° is colored carmine-red, and above and below 50° and 150°, green. The author prepared such a thermometer six years since, which he is still using. The cost of such a thermometer should not exceed four marks (one dollar). Comparison with a new thermometer gave the following results: —

Hg	—20.6°	0	40.5	100	205.
H_2SO_4	—21°	0	40.5	99.5	204.

RAILROAD NOTES.

A Gas Locomotive. — In Melbourne, Victoria, says the *Journal of Commerce and Intercolonial Trade*, a gas-locomotive has been running for several months on one of the tramways, so far to the satisfaction of all concerned. The coal-gas is carried in four copper containers, about six feet long by sixteen inches in diameter, which, as the gas is compressed to about fifteen atmospheres, hold two hundred and eighty cubic feet, or sufficient for a run of fifteen miles. In practice, the gas has rarely been pressed to more than a hundred pounds, as that gives an ample supply to run the locomotive and its car twice on its journey. The reservoirs or containers are refilled as required at the station; and the average consumption of gas per day of about eight trips, or forty miles, is seven hundred and two cubic feet, which in London would cost about forty-four cents. The locomotive weighs four and one-half tons, and the car thirty-five hundredweight, an Otto gas-engine being the motor.

Railroad-Building in 1886. — The new railroad mileage built last year, according to statements recently published, reached eighty-one hundred miles, a total which has been heretofore exceeded only twice. The greater part of last year's new mileage was west of the Mississippi River, both the North-west and the South-west coming in for a share. The building of parallel lines, which has for the present practically ceased in the Eastern States, is now very active in the West. Much of this is due to the rivalry of the great Chicago and St. Louis companies, and their fear of losing business should a competing line be the first to take the business of a new district.

State Railroads. — It is reported that the State management of railways has proved a practical failure in all those countries where private lines have been allowed to compete with it. Instead of the government regulating the private railroads, as it was expected to do, it is regulated by them, and has had to adjust its terms to meet those which they imposed. In Belgium, the government railroads, and the canals, also owned by the government, have had something very like what we call a "railroad war" with one another. The "mixed system" has been abandoned, in Belgium and Prussia by State management having become almost universal, and in Italy by its having been practically given up.

Bridge-Testing. — A novel method of measuring the deflection of railway bridges, tried in Russia, is described by *Engineering:* "An iron pipe, one and one-half inches in diameter, was carried along the outside of one girder. From this pipe, at each abutment at the pier, and at five intermediate points on each span, vertical pipes of the same diameter branched out. Inside, and near the top of each vertical pipe, was fixed a graduated three-quarter inch glass tube, the iron pipe being cut away on both sides. The zero divisions on the tubes were all the same distance above the flange of the girder. Before the bridge was loaded, the apparatus was filled with water, the tops of the upright pipes covered over, and the water was then drawn off until it stood at zero in each gauge. On the bridge being loaded, the deflection could be read with ease."

INDUSTRIAL MEMORANDA.

Battery Residues. — A Parisian electrician has devised a mode of utilizing the residual liquids from bichromate and other powerful batteries. He mixes a porous acid-proof substance with the residual liquids, dries the paste thus produced, and uses it as a charge for batteries for telegraphic purposes.

Application of Electricity to Weaving. — A manufacturer of Roubaix has invented a very curious application of electricity to looms. He adopts an indicator which strikes when a thread breaks, and thus saves the weaver from the close attention to the quickly moving threads which is so injurious to the sight.

Underground Wires. — Mr. R. S. Culley, the author of *A Practical Handbook of Telegraphy*, says that more than thirty years ago underground wires were tried in England; one system running along the London and North-western Railway from London to Manchester, Liverpool, and Leeds, another along the high-road from London to Carlisle. Neither worked more than five years, although constructed with the greatest care, and at much expense. The method adopted in Germany is to form a complete cable, just as for submarine work, with a sheath of galvanized steel wire, and to coat it with bitumen while laying it in a deep trench. The cost is great, but so is that of the annually recurring break-down of overhead lines.

A Widespread Reputation. — The fame of that model industrial establishment, the Waltham Watch Factory, has extended even to France, and a recent number of *La Nature* contains a full description of the factory, illustrated with engravings taken from photographs of the different workrooms.

Electric Lighting of Railroad Cars. — A car has lately been running upon the Boston and Albany Railroad which is fitted up with incandescent lights fed from accumulators carried underneath the floor. These are charged during the day from a dynamo-machine, and in the evening furnish a safe and brilliant light as long as the car is in service.

Solid Carbonic-Acid Gas. — The manufacture of solid carbonic-acid gas is said to have become a settled industry in Berlin. It is put up in small cylinders, and, if kept under pressure, will last some time; that is, a cylinder one and a half inches in diameter, and two inches long, takes five hours to melt away into gas.

Delicate Photography. — German photographers have succeeded in photographing a projectile in the course of its flight, and some of the photographs show the head of condensed air which precedes every shot. It is this "head" which prevents even skilful riflemen from hitting an empty egg-shell when hung on a long thread. The air blows the shell out of the way of the bullet.

Electric Lighting of Rome. — A company of Italian capitalists has undertaken to light Rome by electricity under a new system. The plant of the company will be operated by water-power furnished by turbine wheels in the Tivoli water-falls.

Home, Farm, and Garden.

THE CHEMISTRY OF THE LAUNDRY.

That important article of household use, soap, is of considerable interest from a chemical point of view. It is a true salt, or compound of an acid and base, in which the acids occurring in fats, where they are combined with glycerine as a base, are separated from it, and combined with the alkali soda or potash. Soaps in which the fatty acids are combined with lime, magnesia, lead, or iron, are also known, but are only used for medical purposes.

The crystalline salts of soda are, as a general rule, *efflorescent;* that is, on exposure to the air, they give off moisture, and crumble into a dry powder. Potash salts, on the other hand, are oftener *deliquescent*, absorbing moisture from the air, and becoming liquid. This is also true of the soaps made from these alkalies; hard soap being made from soda, and soft soap from potash.

A good soap should be perfectly neutral, containing neither excess of fatty acids or alkali. An excess of free alkali in a soap will increase its cleansing power, but has an injurious effect upon the skin and clothing. It is a common practice to add carbonate of soda to laundry soap for a similar purpose, but its use cannot be recommended.

The cleansing action of soap cannot be very satisfactorily explained, but it is doubtless due to the alkali contained in it. Probably some sort of double decomposition takes place between the soap and the greasy impurities of the skin or soiled linen, by which they are rendered soluble in water.

Washing-powders are almost always composed of carbonate of soda. They may occasionally be of use in removing very obstinate spots, but their constant use causes the clothing to wear out very rapidly. Borax is less objectionable, and may sometimes serve a good purpose as an auxiliary to the soap. Ammonia will often remove stains which are not affected by the ordinary cleansing process, but so powerful an agent should be used with care.

The process of bluing illustrates an important law of color. Freshly washed linen is of a slightly yellowish tint, which appears to be an optical illusion depending upon its excessive whiteness. Now, blue and yellow are *complementary* colors; that is, when blue and yellow light are combined, white light is formed. So the addition of a trace of blue color to the linen neutralizes the yellow tint, and renders it apparently perfectly white. Bluing is usually made from indigo, though Prussian blue, ultramarine, and aniline blue are sometimes used. The same process of bluing is applied to sugar to give it a whiter appearance.

Starch is a vegetable product, usually procured from potatoes, and, when in its natural state, consists of separate grains easily distinguished under the microscope. Upon boiling with water, these grains burst open, and the contents are partially dissolved in the water. Upon cooling, it forms a viscid jelly, or rather emulsion, as the starch seems to be more in a state of minute subdivision than in a condition of solution. When cloth is saturated with it, and pressed with a hot iron, the starch is transformed into a gummy substance, which gives the requisite stiffness to the linen. The polished appearance which is sometimes given to starched articles is produced by adding various substances to the starch, among which are gum-arabic, gelatine, or paraffine.

Of the most important article used in the laundry, water, there is little to be said. We may mention, however, that the object of sprinkling dry clothing before ironing is, that the steam formed by the heat of the iron may soften the cloth, and allow it to be pressed smooth. It is also to be noted, that clothing will dry in the air when the temperature is below freezing, as well as on warmer days; thus showing that water evaporates, even when in a frozen condition.

THE MYSTERIES OF PLANT-GROWTH.

II.

How do plants absorb and elaborate the inorganic matter necessary to the food of those graminiferæ which afford to man the bulk of his animal sustenance? What process is undergone in the assimilation of carbon, hydrogen, oxygen, and nitrogen, which, in the form of carbonic acid, water, and ammonia, are taken from the air and the soil?

While promising to do my best to answer these questions, I must remind my readers that a great many of the phenomena relating to plant-life are still shrouded in a veil of mystery, beneath which Dame Nature has prohibited any peeping, and hence we are unable to define causes for many well recognized effects. There has been, however, a stupendous amount of earnest and good work accomplished during the last sixty years; and the resulting knowledge now forms a massive foundation, upon which scientific agriculture is built up, and which I may briefly summarize as follows: —

A. — Plants require for their nourishment and prosperity a given quantity of food, composed in varying proportions, and, according to their different natures, of hydrogen, oxygen, nitrogen, and carbon, and of phosphates, sulphates, and chlorides.

B. — The hydrogen and oxygen, in the form of rain or dew, are supplied as water; and the nitrogen and carbonic acid are mainly derived from the air.

C. — Good virgin soils contain the whole of the necessary minerals, in addition to considerable quantities of nitrogenous and carbonaceous matters.

D. — Long-cultivated and non-productive soils may be termed exhausted, since chemical analysis proves their inability to furnish the needful substances in quantities equal to those found in the ashes of healthy plants.

This being, *grosso modo*, the actual stage of our progress, let us proceed to examine and discuss the probable manner in which vegetation absorbs and elaborates the elements it requires

Plants derive their carbon from carbonic-acid gas, which, as it is hardly necessary to add, is a combination of carbon and oxygen. It exists in a free state in the soil, is vomited forth in torrents by all volcanoes, escapes from many mineral waters, and is exhaled from all sorts of underground exploitations, and especially from coal-mines. It is still more abundant in its combination with various bases to form carbonates, and, particularly as carbonate of lime, constitutes the greater portion of the earth's crust. All these, however, do not represent the sole sources of the carbonic acid contained in the atmosphere, where its volume is continually added to by the enormous quantities arising from combustion, fermentation, putrefaction, and respiration.

The average man is calculated to consume or internally burn from two hundred to two hundred and twenty grains of carbon per hour; and the quantity of oxygen necessitated by this combustion, and withdrawn from the air by the whole human race every year, attains the figure of five hundred and seventy-five billions of cubic feet, which is replaced by a nearly exactly similar volume of carbonic acid, resulting from the process.

These quantities are quadrupled by the various species of animals; and an acre of ground, when properly manured, exhales at least a hundred and fifty cubic feet of carbonic-acid gas in every twenty-four hours

I have already explained that its proportion in the air is four ten-thousandths; or that, in other words, there are in every ten thousand grains of air, *four grains* of carbonic acid. The production of these vast quantities would, therefore, seem to point to an inevitable accumulation of this element; but so wisely have things been ordained in nature, that simultaneously with its creation there arise causes of absorption which perfectly maintain the constant equilibrium.

While man and animals are absorbing oxygen and exhaling carbonic acid, all kinds of green plants are absorbing the latter under the influence of light, to form their carbon, and giving off oxygen in sufficient volume to establish a compensation.

Those of my readers who doubt the exactness of these statements may easily verify them by the performance of a simple experiment.

Two or three freshly gathered green leaves are placed in a thin globe-shaped glass bottle or flask, from the bottom of which protrudes about an inch of small glass tubing, drawn at the end to a very fine point, and closed with sealing-wax. The bottle is filled to the brim with weak seltzer-water, turned upside down in a basin, and exposed to the rays of the sun.

In a short time, small gaseous bubbles will form on the leaves, and rise to the surface of the water in the bottle; and that these bubbles are not composed of carbonic acid, which is an uninflammable gas, may be proved in the following manner: —

The end of the sealed glass tube is broken off so as to permit the introduction of a match, which, though extinguished, still retains at its extremity a dull, dying, red spark. Upon coming in contact with the bubbles, this spark will instantly develop into a brilliant flame, and thus demonstrate the evolving gas to be oxygen.

The discovery of this remarkable phenomenon was made by Bonnet in 1750; but it was Priestley who obtained the Copley medal for definitely working it out, and for showing that the vitiated air arising from the processes of combustion and respiration is restored to, and maintained in, a state of complete purity by the counteracting influences of vegetation.

I intentionally emphasized that the absorption of carbonic acid by plants is greatly facilitated by, if not solely dependent upon, the action of light; and I have made innumerable experiments to prove, that, when they are kept in the dark, they absorb instead of evolving oxygen, and exhale carbonic acid.

Several distinct species of water-plants were dug up from a marshy plot of land, and placed in jars

filled with water in a dark cellar. A minute daily examination of the water showed them to be rapidly absorbing the oxygen it held in solution, and replacing it by carbonic-acid gas. As the oxygen lessened in quantity, the plants gradually changed their aspect from that of health to that of decay, until, all the oxygen having disappeared, they finally died from asphyxiation.

A further series of experiments consisted in planting the seeds of several of our ordinary green vegetables simultaneously in the dark cellar and in the outside soil; and this resulted in a very curious phenomena.

The plants which germinated, and developed in the outside soil, presented their normal appearance of green; but those which were growing in obscurity remained of a dirty-white color, and constantly lost their carbon.

Cloës and Dumas have investigated this phenomenon, and discovered that the principal substances found in the organisms of plants grown in the dark are almost identical with the most important of those found in various animals; thus, from the former we eliminate *asparagine* ($C_4H_8N_2O_3$), and from the latter *urea* (CH_4N_2O).

No satisfactory explanation of the cause of this effect has yet been offered; but we may presume that it originates in the evolution of carbonic acid, — the loss of carbon, — and the consequent incomplete combustion of the nitrogenous bodies.

My own conclusion is, that the green matter of vegetables is formed under the direct influence of light, and that it is solely to this green matter, whatever its composition may be, that their absorption of carbonic acid is due.

When we remember that one pound of carbon (as it exists in wood-charcoal), when combining with oxygen to form carbonic acid, produces in the process of combustion a heat which is capable of raising 8,080 pounds of water from 0° to 1° Centigrade, we may very naturally imagine, that, to decompose the gas thus formed, an equal amount of heat must be required. But here we arrive at the restriction of our knowledge, and are obliged to have recourse to logical supposition.

Presuming, however, that the heat generated by the combustion is caused by the violence of the shock which takes place when the molecules of carbon and oxygen are drawn together, the inference is, that their disunion necessitates an effort equalling in force the heat engendered by their combination.

Now, this gigantic effort, this decomposition of the carbonic acid of the atmosphere, which enables plants to retain its carbon, and set its oxygen free, suggests the direct influence of the sun's rays, exercised in an exactly similar manner to that which characterized its agency in the formation of the coal-deposits which now serve us for fuel.

I have already dwelt at considerable length upon the elements which form the *ultimate composition* of vegetable bodies, but have made no mention of what are called their proximate principles.

The proximate principles found most abundantly in plants are the carbo-hydrates — glucose, dextrine, starch — and cellulose; so that here again we enter the domain of hypothesis, because, although chemical analysis has shown these bodies to be nothing but carbon and water, no human ingenuity has yet been able to discover a method of so combining water and carbon as to produce them artificially.

This absence of any absolute proof as to the real nature of the transformations which go on in plant organisms, has induced some chemists to ask why the proximate principles, instead of resulting from a union of carbon and water, should not with equal reason be presumed to arise from a combination of hydrogen and carbonic oxide. Nor is the question irrational if we remember, that, although when a given quantity of atmospheric carbonic acid is decomposed, it is replaced by an almost equal volume of oxygen, there is nothing in the present case to show that the oxygen evolved by plants solely proceeds from the decomposition of the carbonic acid. Why should we not assume that they transform this gas into carbonic oxide and oxygen, while decomposing their water into oxygen and hydrogen? The illustrious Boussingault looked with great favor upon this theory, — a fact sufficient in itself to forbid its rejection as more imaginary than any other hypothesis; and I personally see no reason why the carbonic oxide, by uniting with the nascent hydrogen, should not produce a substance isomeric with glucose, while allowing a volume of oxygen nearly equal to that of the absorbed carbonic acid to be evolved.

Let me attempt to illustrate this by the following figures: —

Carbonic acid.		Water.		Glucose or its isomeric.		Oxygen.
$C O^2$	+	H_2O	=	$C.H_2O$	+	O^2
2 volumes.		2 volumes.				2 volumes.

This is a very seductive branch of my subject, one which ever opens up fresh fields for speculative thought. I therefore leave it with regret, though not without the hope that our darkness may be ultimately dispersed, and our present perplexity thus set at rest forever.

FRANCIS WYATT, PH.D.,
New York Mercantile Exchange.

A PLANT OF GREAT ANTIQUITY.

THE ONION.

BY K. B.

AN ugly, uninteresting bulb, hidden away in our cellars, who would think it had a past, a glorious past, reaching far back to the very beginning of history?

To-day we may see it cultivated in almost every part of this great republic. Three centuries ago a mere handful of colonists from Europe sowed the first seed in this Western world, and awaited anxiously for the first crop of onion-bulbs.

Three hundred years takes us back to the England of Elizabeth, in which the onion is well known. Indeed, its properties are so familiar to all, that Shakespeare and his actors can rely on the mention of its name to bring even to the dull brains in the pit a vivid picture of tears without woe.

Chaucer, writing two hundred years before this, mentions the onion as a well-known domestic vegetable. Three or four centuries earlier it was a newcomer into England, and was probably liked only by those who affected a French taste in cookery.

A thousand years sweeps away the history of England, and leaves a small island torn with the strife of its recent Saxon conquerors, and harassed by sea-pirates, — an island almost unknown to the nations of Europe, who have enough to do to hold their own from each other and from foreign foes.

Another thousand years, and Britain is an island lying far, far away from civilization. Vague rumors of a land beyond the sea, there may be; but vagueness lends terror, and makes the island the abode of monsters and ogres. Wars rage in Europe, and Rome is pushing her conquests to the east and west; yet under the soft Italian skies the onion flourishes, and many varieties are grown for the tables of the rich. Gourmands discuss the different flavors, and call their favorites by the names of the countries lately brought under Roman rule.

Two thousand years have taken us back to the border-land between history ancient and modern. Seven hundred more, and the Father of Song himself will stir our hearts as he tells of valiant deeds around the walls of Troy. With him we enter the tent of Nestor, where for us the maid of the fair curls brings forward the "beautiful, well-polished table, with golden legs," and on it places "a basket of bronze, and in the basket *an onion*, — flavor for the wine." Ulysses we see "with a beautiful garment around his body like as the rind of a slender *onion*, so soft is it, and shining like the sun"

A few hundred years more, and we shall hear the groans of the Hebrews in Egypt as they drag the heavy stones for the massive forts of Rameses and Pithom, or make their daily tale of bricks under the sharp gaze of guards standing over them with rods. Rameses the Great is on the throne of Egypt; his vigilance leaves no loophole for escape. But death, greater than Rameses, takes the mighty conqueror; and Menephthah, his son, rules in his stead. A successful conspiracy is made, and we hear songs of triumph as these emancipated slaves take their first steps in freedom. But the mood soon changes; the privations of the desert for the moment seem worse than the toils of their late slavery, and, reviling Moses, they ask him bitterly, "Who shall give us flesh to eat? We remember the fish, which we did eat in Egypt freely; the cucumbers, and the melons, and the leeks, and the *onions*, and the garlic."

And these onions, whose flavor could be better remembered than the hardships of Egyptian bondage, can they be of the same species as the onions of our own gardens? Certainly they are; they are grown in Egypt to this day, and are called now by the very name that was shown to Herodotus on the Great Pyramid, where it was "marked in Egyptian letters how much was spent in radishes and *onions* and garlic for the workmen." More than this, the designs on the ancient monuments show us often this very onion. For the onion was highly prized by the Egyptians; and one variety was so excellent in all its properties, that it was worshipped as a god.

Six thousand years ago, when a few wretched savages, scattered over Europe, were tearing from nature a bare subsistence, in the valley of the Nile the Egyptians were enjoying a happy, peaceful, and sometimes jolly life. The tombs of Memphis are covered with pictures of feasts and games, dances and boat tournaments, poets chanting verses, and girls dancing, their hair bedecked with gold. Even then Egypt was an old country, and its agricultural life was rich with oxen, asses, dogs and monkeys, antelopes and gazelles, geese, ducks, swans, and slaves of Numidia.

But Egypt is not the only old country. Afar off to the eastward, and all unknown to the rich farmers of the Nile, the Chinese also were practising the arts of agriculture. And in China, as in Egypt, our onion was esteemed and cultivated many ages before the civilization of Europe began.

Between Egypt and China lies a vast country, of which we discern only the north-west corner. Across the rugged mountains, and into the land of the Five Rivers, come small bands of wanderers, whose forms, like shadows, pass over the fertile plain. Lingering here and there, they scatter seeds brought from their native land, and, not least valuable of their crop, gather in an annual harvest of onions.

Darkness lies over the country beyond the mountains. Could we but pierce its gloom, we might see our onion receiving its first care from the hand of man, or, in a still older past, growing wild around the dwellings of a primitive people, — a small, slender onion, but none the less the parent of the onions of India, China, and Egypt, and of all the onions cultivated anywhere and everywhere over the face of this wide world.

The Popular Science News.

BOSTON, APRIL 1, 1887.

JAMES R. NICHOLS, M.D.
WILLIAM J. ROLFE, A.M.
AUSTIN P. NICHOLS, S.B. } . . . . . *Editors.*

The unsatisfactory appearance of modern city houses is a matter worthy of attention. The ornamental and attractive "Queen Anne" and other styles of country and suburban houses leave little to be desired either in the way of beauty or comfort; but it would seem as if the problem of erecting a convenient house, with any pretensions to architectural beauty, upon the limits of a city lot, was too difficult for the architects to solve. Nothing can be more depressing than the long rows of "blocks" which occupy the streets of our cities, though it is, perhaps, a matter of congratulation that that architectural monstrosity, the "high stoop" arrangement of the entrance, is almost entirely confined to the city of New York. Many people, either from necessity or choice, must spend the greater portion of their lives within the narrow limits of a city dwelling, and a fine opportunity is offered for some enterprising architect to gain wealth and reputation by giving it some individuality, and rendering its external appearance as attractive as possible.

The recent terrible railroad accidents have directed public attention to the dangerous methods of heating and lighting cars at present in use. While all admit that a change is desirable, it is hard to suggest any plan which shall be at once safe and practicable. There are many difficulties in the use of steam from the locomotive for heating the cars which are not appreciated by the general public, and the use of electricity for lighting cannot yet be said to have proved a success. We have no doubt that some means will soon be devised by which the danger of the burning of cars in case of accident may be prevented, but no perfectly satisfactory inventions for this purpose have as yet been brought forward.

The recent earthquake in France adds another to the remarkable list of such occurrences during the past two years. There is little to be said upon the subject, for we neither know their cause, nor can we predict their recurrence. Judging by the Charleston and other earthquakes, there is a strong probability that the worst and most destructive shocks have ceased; but, in absence of any direct proof, it will be a long time before confidence in the stability of the earth will be re-established. The large loss of life connected with this catastrophe will excite the heartfelt sympathy of the entire world.

As might have been expected, numerous self-styled scientists have claimed to have predicted the earthquake, either from an eclipse of the sun which occurred about that time, or from some other equally absurd cause. The irrepressible Wiggins has bobbed up serenely from a Canadian snow-drift, with the remark, "I told you so," and a dire prediction of worse things to come. It is hardly necessary to inform our readers that it is impossible, with our present knowledge, to make any prediction whatever regarding future earthquakes; and any one pretending to do so, must be either a knave or a fool.

The inclination of mankind to follow after impostors of every kind, is rather remarkable. A man like Wiggins, whose brains are in his tongue, can make prediction after prediction of storms, earthquakes, and all manner of meteorological evils; and, in spite of their inevitable failure, each fresh prediction appears in every newspaper in the country, and frightens some nervous people out of their few wits. There are still shrewd business-men who have faith in the Keeley motor, and are supplying the inventor of that famous engine with funds to facilitate the adjustment of his "etheric molecules." The advertising quack doctor will have a hundred patients where the skilful, scientific physician will have one. And, at the word of some blatant demagogue, thousands of hard-working men will stop their employment, and transform themselves into enemies of public order. A medical contemporary compares the phenomena of the recent strikes to those of the imitative nervous disease with which certain Siberians and Canadian backwoodsmen are affected, known as "myriacht," or "the jumps;" and the automatic, unreasoning imitation with which people sometimes follow each other, to their own injury or destruction, is certainly very suggestive of a nervous epidemic.

Some very curious errors on scientific subjects are often made by novel-writers, in their attempt to introduce sensational scenes or situations. Charles Dickens, in *Bleak House*, caused one of his characters, a drunken, alcohol-soaked wretch, to perish by spontaneous combustion, and always refused to be convinced of the impossibility of such an occurrence. In more recent times the author of that classical work, *The Innocents Abroad*, speaks of the appearance of the full moon in the same place in the sky for several nights in succession, owing to the fact that the travellers were sailing to the eastward at a speed which enabled them to keep up with the moon's motion around the earth. In a recently published story, *King Solomon's Mines*, the author describes a total eclipse of the sun which was visible over the entire southern part of Africa, and continued for an hour, regardless of the fact that such an eclipse can only be total over a belt of country 173 miles wide, and never lasts more than four minutes, under the most favorable conditions. He also describes, at much length, a night-scene in the neighborhood of the "mines," in which he causes the *crescent* moon to rise above the eastern horizon just as the sun is setting in the west. It is very sad to spoil such a beautiful description; but the hard astronomical facts are, that the crescent moon never behaves in such an extraordinary manner, and, like many of the inhabitants of the earth, our nocturnal luminary never stays out all night, except when at the "full."

Orthochromatic photography, which is now becoming an important branch of the art, is not, as many suppose, photography in colors, but rather photography *of* colors. If, for instance, an oil-painting is copied in the usual manner, all the yellow tones, which to the eye appear light, will be more or less dark in the photograph, while the darker blue tones will be nearly white. This is due to the fact that the blue rays are accompanied by a much larger proportion of actinic or chemical rays than the yellow. By covering the sensitive plate with certain fluorescent bodies, among which eosine and erythrosine have given the best results, the length or character of the waves of colored light are so changed that they are photographed with their proper gradations of light and shade. We have recently seen a photographic copy of an oil-painting made by this process, in which the most beautiful effects have been obtained. The softness and delicacy of the shading is such that it resembles rather a crayon drawing than a photograph; and, as the process has only recently been made practical, it is probable that even greater success will be obtained with it in the near future.

The best method of inflicting the death penalty has been a matter of considerable discussion recently. The method of hanging, now in vogue, is uncertain, barbarous, and demoralizing to the public; and there is no reason why science should not come to the aid of justice, and suggest some more humane method of carrying out the extreme punishment of the law. Of the strictly mechanical methods, the French guillotine is perhaps the least objectionable; but a dose of strong poison, or a powerful current of electricity, are among the best methods. The mysterious nature of a death occurring under such conditions, and the absence of the excitement and notoriety of a public hanging, would also produce a feeling of terror in the minds of the criminal classes, and tend to prevent the commission of capital offences. Every principle of justice and humanity demands a change from the mediæval practice which has come down to us through our British ancestors.

It still seems to be an unsettled question whether wood can be ignited by the heat of a steam-pipe in contact with it. Theoretically, it is impossible for wood to take fire at a temperature of 212° or some degrees higher; but there have been many cases of fire reported as occurring from this cause, and the evidence is very conflicting. We should be glad to hear from any of our readers who can offer additional information upon the subject.

[Special correspondence of the *Science News*.]

THE EARTHQUAKE IN FRANCE.

A rather severe series of earthquakes has been recently experienced in France, a country which is generally not a shaky one, — geologically considered, at least, for none is more so from a political point of view. It may be presumed that the earthquake is over; such accidents are rarely of long duration in non-volcanic regions: and, although Vesuvius is not very far from the part of France where the earthquake occurred, the shocks were by no means felt in the vicinity of it, and it is so very insignificant a volcano at present that it very probably has nothing to do with them.

The first earthquake, which was also the strongest, occurred on Feb. 23, at 5 55 A.M. in Nice and the surrounding region: it was experienced at about 6.30 in the Italian Riviera. The difference of time must be accounted for by the difference of legal time in Italy and France, the one being regulated by Paris, the other by Rome. This first earthquake was experienced over a great space of Southern France and Northern Italy.

In Italy it was felt, in Turin, where the clocks were all stopped, and church-bells set ringing of their own accord, causing the whole population to spring out of bed and into the streets, with scant clothing, running for dear life, and perhaps also to get warm, as the thermometer was at 23° F.; in Alexandria; in Savona, where many houses and walls were cracked; all along the coast, where accidents were numerous, many persons being killed by stones and chimneys; in Milan; in Genoa; in Rome; in Pavia, etc.

In France it was felt from Lyons, where it was weak, to Ajaccio in Corsica; and from Marseilles to Ventimiglia, on the Italian frontier. Among the French Mediterranean towns, Nice and Mentone are those where the earthquake has been the most violent, the remainder being slightly affected. It was a singular sight in Nice, when, at 5.55 of the morning, after the festivities of Carnival, the whole population turned out in alarm, women shrieking and crying, with babes half dressed; some people coming out of late balls dressed in *arlequins* or *pierrots*, yet paler from fear than from all their *poudre de riz*. Many deaths were the result of the falling of stones and balconies; one, that of a young English girl, was the result of pure fright. In Mentone the same scenes were witnessed. The property loss is very great, many houses being unsettled, cracked, and fissured; balconies being broken off, chimneys having fallen, church towers having toppled over. In Italy the property loss is less important, owing to the less abundance of wealthy inhabitants, and absence of winter resorts, save San Remo and Bordighera: but deaths are much more numerous; in a village near San Remo a church was ruined during the six-o'clock mass, and three hundred persons were killed or severely wounded.

Some three or four thousand people have been killed in Italy. In Italy, as well as in France, all those who were able to go, left the country; others staid, but, of course, refused to remain in their houses, and camped out in open places, — in the fields and woods, on the seashore, in tents, carriages, or in nothing at all, according to their means, owing to the possibility of fresh tremors which might complete the work of the first. Although some other shocks were felt, none did much harm; none was as severe as the first. Some were experienced towards 8.30 A.M. the 23d of February; the others followed the next days.

Some earthquake tremors have been experienced in Africa, around Tunis, and also in Greece.

No precise documents of any value have been yet published concerning the features and character of the earthquake.

The Nice observatory has published nothing yet, but its documents will certainly be very valuable. The Turin observatory says that the movement was from north-east to south-west.

At sea, some captains say their ships experienced a peculiar thump, as if they had gone on rocks. On shore, some persons say the sea was agitated and queer during the tremors; it is also reported that the sky was "on fire." At 5.55 A.M. this is rather singular, and it is likely that the imagination of the unfortunate people was more on fire than the sky.

As to the cause of the phenomenon, nothing can be presumed before a careful study of the results and geological conditions of the earthquake can be ascertained. Even then, of course, it is only mere suppositions that can be offered. It is not a volcanic phenomenon, no more than was that of Charleston, although exterior manifestations of underground heat seem to have been present in the case of Charleston. Is it due to a sudden contact of cold sea-water with warm rocks through deep fissures, and to the consequent development of a quantity of steam and gases? Is it the result of mere globe-cooling, of the crumpling of the crust which does not exactly rest upon the denser central parts? Is it due to solar and lunar attraction on the liquid centre? No one knows, and nobody will ever know. The theories pertaining to earthquakes are all very interesting and ingenious; they all suit some cases very well: but it is impossible to say where they fit, and where they do not. Hesitation is all the more a comprehensible and necessary thing when one perceives how very little geologists concur on fundamental globe questions, such as the fluidity or non-fluidity of the central part of our planet.

It seems, however, very probable that the recent earthquakes in France have nothing to do with volcanic phenomena, although Hawaiian Mauna-Loa, an old friend of early days, has begun making mischief again. That is a fine place for earthquakes, Hawaii; and when I meet some scared refugee from the Mediterranean coast, trembling for fear yet, but nevertheless proud of having gone through the thing, I always speak to him of the really frightful succession of earthquakes experienced in Hawaii during 1868, when in the single month of March over two thousand distinct shocks were counted and felt (some of them very strong, and the minor ones are not comprised in this reckoning), so that the earth was in a constant state of tremor and fever till one was seasick. But human nature is always the same; the people who have experienced three small earthquakes think more of those three than they do of the three thousand of their neighbor, and wish to impress the idea that those three were something terrific.

The French earthquake has been a very moderate one. To be sure, many lives have been lost, especially in Italy; much personal property has been destroyed; but this has been a very quiet manifestation compared to those in which Dame Nature sometimes indulges.

H.

Paris, *Feb.* 27, 1887.

[Specially reported for the *Science News* from the Observatory of the College of New Jersey.]

ASTRONOMICAL PHENOMENA FOR APRIL, 1887.

Mercury will not be in a favorable position for observation during the month. It reaches its greatest elongation on April 17, when it is over 27° from the sun, rising before it; but, as it is at the same time 8° south of that body, it will not rise long enough before it to be well seen. Venus is an evening star, and is very conspicuous in the western sky in the early evening. It sets rather more than two hours after the sun. Mars cannot be seen during the month. It passes conjunction with the sun, and becomes a morning star on April 24; but it will not be near enough to the earth and far enough away from the sun (apparently) to be a very conspicuous object until autumn. Jupiter comes to opposition with the sun, and is on the meridian, about midnight on April 20. At the beginning of the month it rises about 15° south of the east point about an hour after sunset; at the end of the month it rises in nearly the same place an hour before sunset. At the beginning of the month it is about 12° east of the first-magnitude star Spica (*Alpha* Virginis), and during the month this distance will decrease to about 8°.

Saturn is in quadrature, and crosses the meridian about six hours after the sun on April 5, and during the month will be in the western sky in the evening; at the end of the month it sets a little before midnight. It is still south and west of Castor and Pollux (*Alpha* and *Beta* Geminorum), but is moving eastward slowly, and is nearer those stars than it was during March. On April 24 it passes near the third-magnitude star *Delta* Geminorum; the distance, when least, being only 12′, or about two-fifths of the moon's diameter. Uranus is on the meridian about midnight on April 1, and two hours earlier on April 30. It is near the third-magnitude star *Gamma* Virginis, about 2° south and 1° east at the beginning of the month. At the end of the month it is about 2° distant, nearly due south. Neptune is about 6° south of Pleiades.

A new and faint comet was discovered on Feb. 17 by Mr. E. E. Barnard of Nashville, Tenn. It passes perihelion on March 28.

M.

Princeton, N.J., *March* 1, 1887.

METEOROLOGY FOR FEBRUARY, 1887, WITH REVIEW OF THE PAST WINTER.

TEMPERATURE.

Average Thermometer.		Lowest.	Highest.	Range.
At 7 A.M.	21.96°	0°	39°	39°
At 2 P.M.	31.46°	16°	46°	30°
At 9 P.M.	25.07°	5°	38°	33°
Whole month	26.17°	0°	46°	46°
Second average	25.89°	0°	46°	46°
Last seventeen Februarys,	25.60°	17.81°, in 1885.	31.38°, in 1877.	13.57°
Second average	25.40°	17.54°	31.21°	13.67°
Winter of 1886-87	24.56°	—14°	51°	65°
Last seventeen winters	25.80°	21.85°	31.68°	9.83°

The lowest point reached the past month was zero, on the morning of the 5th; and the highest 46°, on the 16th. The coldest days were the 5th and 13th, each with an average of 10⅔°; and the warmest the 15th and 16th, each at 38⅔°. The entire month was a full half-degree above the average for February. The temperature has been changeable, but with less extremes than usual for this month. Several sudden changes occurred, in connection with the cold waves, on the 5th and 14th; the mercury falling 25° in the former case, and

rising 34° in the latter, in 24 hours The month closed with more steady, protracted, cold, uncomfortable weather.

The temperature of the last winter was 1.24° colder than the average, with extremes of —14° and 51°, — a range of 65°; the extremes in seventeen winters have been — 20°, in 1873, and 66°, in 1874, — a range of 86°.

SKY.

The face of the sky in 93 observations gave 41 fair, 4 cloudy, 27 overcast, 5 rainy, and 7 snowy, — a percentage of 48.8 fair. The average for the last seventeen Februarys has been 57.6, with extremes of only 30, in 1884, and 73.4, in 1877, — a range of 43.4, the largest on my record; 30 per cent fair is the lowest of any month in seventeen years.

The percentage fair the last winter was 46.4, and for the last seventeen winters 53.7, showing the present to have been 7.3 per cent less fair than usual.

PRECIPITATION.

The amount of rainfall, including 13¼ inches of snow melted, was 6.85 inches. The largest amount at one time was 3.33 inches, on the 18th, attended by sharp lightning and thunder for two hours in the late evening. The average amount for the last nineteen Februarys has been 4.97 inches, with extremes of .55 inch, in 1877, and 11.72, in 1886. The snowfall in February came in moderate quantities, and furnished only a week or ten days of imperfect sleighing, mostly near the opening of the month.

The precipitation the past winter, including 62 inches of snow melted, was 20.65 inches, while that of the last nineteen winters has averaged only 13.44 inches. There have been 16 rainy and 18 snowy observations during the past winter, and about forty days sleighing.

PRESSURE.

The average barometer the past month was 30.096 inches, with extremes of 29.20, on the 27th, and 30.75, on the 5th, the highest point reached in any month for fourteen years. The range of the month was 1.55 inches. The average barometer for the last fourteen Februarys has been 29.963 inches, with extremes of 29.834, in 1885, and 30.138, in 1876. This is the fourth time in fourteen years that the average barometer in February has reached 30 inches. The month came in with a high barometer, and continued above 30 inches the first eight days, after which it rose and fell, often rapidly, at short intervals. The sum of the daily variations was 11.71 inches, giving an average daily movement of .418 inch. This average for the last fourteen Februarys has been only .297, with extremes of .162, in 1877, and .418, in 1887. This movement the past month has been very remarkable, exceeding that of every month in the year for the last fourteen years. Some of the largest movements were .98 inch, .75, and .71, with six others above half an inch.

The pressure the past winter has averaged 30.007 inches, while the average for the last fourteen winters has been 29.960. The winter months are peculiarly agitated in this respect. The daily movement the past winter was .336 inch, and that of the last fourteen winters .285. This is in wide contrast with the summer months, which have an average daily movement of only .097 inch.

WINDS.

The direction of the wind in 93 observations gave 16 N., 2 S., 2 E., 23 W., 4 N.E., 23 N.W., 6 S.E., and 8 S.W., — an excess of 27 northerly and 42 westerly over the southerly and easterly, indicating the prevailing direction to have been W. 32° 44′ N. The westerly winds have uniformly prevailed over the easterly in February for eighteen years by an average of 43.61 observations, and the northerly over the southerly, with one exception, by an average of 22.11; indicating the approximate average direction of the wind in February to be W. 26° 53′ N. The longitudinal extremes have been 20 and 66 W., — a range of 46 observations; and the latitudinal 41 N. and 4 S., — a range of 45. The relative progressive distance travelled by the wind the past month was 49.93 units, and during the last eighteen Februarys 800.1 such units, — an average of 44.45; showing less opposing winds the last month than usual in February. Toward the close of the month the winds were quite severe, especially on the 24th.

The average direction of the winds the last winter has been W. 25° 7′ N., and the last eighteen winters W. 21° 4′ N., or 4° more northerly than usual.

IN GENERAL.

I may say the past winter in this region has been more than usually stormy, the temperature lower, less fair sky, much more precipitation, higher pressure, and winds more northerly and severe than usual. A combination of such extremes has rendered the winter one to be remembered as uncongenial, and adapted to make spring most welcome.

D. W.

Natick, *March* 4, 1887.

QUESTIONS AND ANSWERS.

Letters of inquiry should enclose a two-cent stamp, as well as the name and address of the writer, which will not be published.

Inquiries sometimes unavoidably remain unanswered till issue of the second number after they are received.

Questions regarding the treatment of diseases cannot be answered in this column.

L. F., *Louisiana.* — Does friction between bodies depend upon the area of surfaces in contact, or upon the pressure upon them? (2) What causes the noise made by a whip-lash?

Answer. — It is generally held, that the friction is *not* dependent upon the area of the surfaces in contact, although it seems rather paradoxical. (2) When a whip-lash is suddenly straightened, it is thrown into a state of tension, and vibrates, like any stretched cord, producing the familiar noise.

G. W. S., *Colorado.* — Is there such a thing as a reliable electric belt?

Answer. — No. Very few of the numerous advertised articles can produce a current of electricity; and, even if they did, their remedial value would be very doubtful. Electricity is only useful when applied by an experienced physician.

A. T., *New York.* — Do potatoes contain fusel-oil, as I have heard stated?

Answer. — Potatoes themselves do not contain fusel-oil, but the cheap spirit sometimes distilled from them contains a larger amount of that injurious ingredient than the whiskey made from corn or rye.

W. P. W., *Colorado.* — An agent is selling, in this vicinity, a burner to be inserted in a common coal-oil lamp. It is designed to burn what he claims to be a cheaper fluid than kerosene, and entirely non-explosive. The wick terminates below the top of this burner, and the fluid is vaporized by the heat of the lamp-flame; the vapor issues from some small holes in the top of the burner, and burns like au ordinary gas-jet. Is it safe?

Answer. — Such an arrangement is extremely dangerous. The "non-explosive" fluid is undoubtedly naphtha, and likely to explode at any time. Any fluid that can be vaporized under such circumstances is unsafe to use, and there is nothing cheaper than *good* kerosene as an illuminant.

D. M., *Texas.* — What is the minutest division of matter recorded?

Answer. — It is very uncertain. Some chemical precipitates, like platinum black, are so fine that the most powerful microscopes cannot resolve them into separate particles: and it has even been held that such substances are in a condition of subdivison closely approximating the original molecules; but this, we think, is doubtful.

F. T. N. — When two volumes of hydrogen and one of oxygen are mixed together, and exploded in a eudiometer tube, a vacuum is formed. What has become of the matter previously filling the space?

Answer. — When two volumes of hydrogen and one of oxygen unite together, one volume of aqueous vapor (H_2O) is formed; that is, three molecules of the mixed gases are condensed into one of aqueous vapor, or steam. This is a *chemical* change; and the loss of volume is due to the *atoms* of the elements coming nearer to each other, forming a new substance. But at ordinary temperatures the aqueous vapor is condensed still further into the form of water, this being a *physical* condensation, where the *molecules* of the aqueous vapor are brought nearer together, without any change in their nature. As three quarts of the mixed gases will only produce about one-tenth of an ounce of water, the extent to which the condensation takes place practically produces a vacuum in the vessel in which they are combined.

C. L., *Chicago.* — The vibrations of the ether which are supposed to constitute the rays of heat, are not, as far as we know, diminished in intensity in passing through space; but, as they are *diverging* rays, the quantity of heat falling upon any given area will diminish with its distance from the source. The aqueous vapor in the air absorbs a certain amount of radiant heat, but it passes through dry air with little or no absorption.

LITERARY NOTES.

The Techno-Chemical Receipt-Book, containing several thousand receipts, covering the latest, most important, and most useful discoveries in chemical technology, and their application to the arts and industries. Edited from the German, with additions, by William T. Brannt and William H. Wahl, Ph.D. Published by Henry C. Baird & Co., Philadelphia. Price $2.00, free by mail.

The title of this valuable work fully describes its nature: but we may add, that the various receipts given in it, which cover nearly all branches of industry, are extremely practical, and will be found useful to all persons, as well as to those directly engaged in manufacturing or scientific enterprises. It is pre-eminently a book for household use, and is, in fact, a perfect encyclopædia of useful information.

Wear and Tear; or, Hints for the Overworked. By S. Weir Mitchell, M.D. J. B. Lippincott Company, Philadelphia. Price $1.00.

This brief essay treats upon the abuse of our physical and mental powers by overwork and excess of nervous excitement, and the prevention and cure of the affections resulting therefrom. Two points of especial interest are touched upon by the author, — the fact that the American people are becoming stouter and less nervous, and the unsuitability of our climate to continued mental exertion. The author's position on the subject of overwork is moderate and reasonable, and the book contains many valuable hints worthy the attention of every one.

Inebriism. By T. L. Wright, M.D., Bellefontaine, O. Price: cloth, $1.25; paper, 50 cents.

In this work the physiological and psychological effects of alcohol are described and discussed in a very thorough manner. While the subject is treated principally from a scientific stand-point, the moral and social evils caused by intemperance necessarily receive the attention which their importance deserves.

A set of *Tables for the Determination of Common Minerals*, by Professor W. O. Crosby of the Massachusetts Institute of Technology, has been published by J. Allen Crosby of Jamaica Plain, Mass. These tables are very complete, and the student of mineralogy will find them a great help in determining unknown or doubtful specimens.

Messrs. D. C. Heath & Co. of Boston have published *A Synopsis of the Nature and Effects of Alcohol and Narcotics*, by L. H. Luce, M.D. It is especially intended to aid the teacher in preparing topics upon the subject for the class, and contains all the necessary information for its proper presentation.

Pamphlets, etc., received: *Contributions to Science and Bibliographical Résumé of the writings of R. W. Shufeldt, M.D.*; *Proceedings of the Michigan State Pharmaceutical Association for 1886*; and the *Bulletin of the Ohio Agricultural Experiment-Station.*

Medicine and Pharmacy.

SOME FACTS CONCERNING THE HUMAN BRAIN AND MENTAL PHENOMENA.

III.

In our study of mental phenomena we find hat the functions of sensation and voluntary motion are not destroyed by the removal of the cerebrum and cerebellum. This has been illustrated by Longet in his interesting experiments with pigeons. But, when we disturb those ganglia immediately connected with the spinal cord, we find that all manifestation of volition and sensation ceases, and even consciousness appears no longer to exist. The only movements that then follow external irritation are the convulsive motions due to the reflex action of the spinal cord. We must, therefore, regard this as the portion of the brain by which impressions conveyed inward through the nerves are first converted into conscious sensation, and in which voluntary impulses originate which stimulate the muscles to contraction.

We see, therefore, from this investigation, that purely intellectual action, which leads us to decide upon voluntary movement, takes place in the cerebrum, and the act of volition itself resides in the ganglion at the base of the brain, called the *tuber annulare*. This act of volition we call *instinctive*. The voluntary impulse follows directly upon the receipt of the sensation. Thus, if a crumb of bread fall into the larynx, the sensation produced excites coughing. We do not cough because we know this to be the most effectual way to clear the throat: there is no intermediate reasoning or intellectual process. All actions of this nature are voluntary in character, but are performed blindly, or without any idea of the ultimate object to be obtained by them, and simply in consequence of the receipt of a particular sensation. The bee builds his cell on the plan of a mathematical figure without making any mathematical calculation; the silk-worm wraps himself in a cocoon certainly without knowing that it is to afford him shelter. Experience, judgment, and adaptation have nothing to do with these actions: they are constantly repeated, with no improvement in the mode of their performance, and with but little deviation under a variety of circumstances.

But in the higher, or *intellectual*, process, the nervous impression received at the *tuber annulare* passes on to the cerebrum, and there gives rise to a special train of ideas. We *then* understand the external source of the sensation, the manner in which it is calculated to affect us, and how, by our actions, we may turn it to our advantage or otherwise. This action we call *reasonable*. It does not depend upon the external sensation, but upon an intellectual process which intervenes between the sensation and the volition. These actions are distinguished by a conscious adaptation of means to ends, not belonging to any other operation of the nervous system. This kind of intelligence, according to Dalton, is not confined to the human species. We have already seen that there are many purely *instinctive* actions in man as well as in animals, and it is no less true that in the higher animals there is often the same exercise of *reasoning* power as in man. The degree of power is much less than in man, but the nature is the same. "Whenever," says Dalton, "we see in an animal an action performed with the evident intention of accomplishing a particular object to which it is properly adapted, such an act is plainly the result of reasoning powers not essentially different from our own." This may be illustrated by a recital of the action of certain animals under peculiar or unusual circumstances. Of these may be enumerated the establishing of sentinels by gregarious animals to warn the herd of danger; the retaliation for punishment inflicted for a particular action, and the subsequent avoidance or concealment of that action; the apparent shame sometimes exhibited by dogs after disobeying their master's commands; the teachability of many animals, and their capacity for forming new habits or of improving old ones. These are all instances of the same kind of intellectual power as in man, and are quite different from instinct, strictly speaking. It is this faculty which especially predominates over the others in the higher classes of animals, and which finally attains its maximum of development in man, because of the superiority of his nervous organization as seen in the size of the brain and the distribution of the gray substance. That animals possess intelligence is clear to those who know them; the only debatable point seems to be the amount and range of that intelligence, and the proper term by which to designate it. Buffon and others of his time gave prominence to the inquiry; and, according to his interpretation, "an animal is simply a material creation which neither thinks nor reflects, although it acts, and seems to form resolutions." He has no doubt that the determining principle of an animal's action is purely mechanical; and yet he admits that the elephant, knowing by the tone of his master's voice whether he is pleased or angry, acts in consequence. He also calls him at the same time "a miracle of intelligence and a monstrous mass of matter." If we attribute all the acts of animals to instinct, the question at once arises, "What is instinct?" May it not be a strong, and at the same time a nervous, manifestation of hereditary intelligence? We find that not only intellectual ability is hereditary, but that talent, taking a peculiar direction, — inclining now to music, astronomy, mathematics, or natural history, — is also hereditary. Of this we have ample evidence in the family names of Darwin, Herschel, and others, as well as by reference to university records, where fathers and sons, and sometimes two brothers, have taken identically the same degree. If instinct can be proved occasionally to modify its actions in obedience to circumstances, what have we then but *individual* intelligence brought to bear upon hereditary intelligence? Some facts concerning the intelligence of animals will be given in another paper.

HYGIENIC ERRORS.

Hygienic and sanitary matters are an inviting field to members of the "crank" fraternity, and one which they vigorously cultivate. There is scarcely a single article of food or dress, or any habit of life, which has not at some time or other come under the ban of such persons; and, if it happens to be an unusually agreeable one, the denunciations of these would-be hygienists are correspondingly violent.

The great mistake which is made in these cases is that of attempting to apply fixed rules of conduct to everybody, without allowing for individual peculiarities. The old rhyme, for instance, —

> Early to bed, and early to rise,
> Makes a man healthy, wealthy, and wise, —

may be applicable to a certain proportion of mankind; but there are many persons who can only do their best work, whether in the pursuit of wealth or wisdom, by the light of the evening lamp, and there is no reason to believe that such a course has any especially bad effect on their health. The prejudice in favor of early rising is also in many cases an unjust one. There is nothing in the air of the early morning which is fatal or even injurious to sleepers. The time to arise is when one ceases to desire sleep, and particularly so in the case of children and young people, as well as the very old. The time of arising should be left as far as possible to the natural feelings, excepting, of course, where the late naps are due to the formation of lazy or slothful habits.

Fresh air in the sleeping-room is of the utmost importance; but to sleep with the windows wide open in all weathers, as advised by some, is a very unwise proceeding, and one likely to do more harm than good. The morning cold bath gives a shock to the system which only vigorous constitutions can withstand. A moderately warm bath is safer for most persons, and a dry rubbing with a flesh-brush is in many cases a much better and safer measure.

Daily exercise is often recommended as a panacea for all ills, and is certainly of the highest importance; but a walk or a ride undertaken without a purpose, and with a constant desire to have the specified time completed, or to finish the allotted distance, is not of much value. A walk of half a mile with a pleasant end in view, in the company of an agreeable friend, is of more benefit than one of several miles with no object but to cover the distance, and return to the house as soon as possible.

As regards diet, the same principles will apply. "What is one man's meat is another man's poison;" and if an article of food is agreeable, and causes no pain or distress, it is a pretty good indication that it is adapted to the needs of the eater. We have often referred in these columns to the false and absurd stories which are so often circulated by ignorant or interested persons regarding the general adulteration of food-products, and it is unnecessary to speak further on that point.

In the matter of wearing-apparel, especially of the gentler sex, the hygienic enthusiast is at his best. If half the statements made concerning the fatal nature of the feminine toilet were true, it is hard to see how any of the wearers could be alive to listen to the denunciations of their folly. While there may be points in which the usual fashion of women's dresses could be modified with advantage, yet, on the whole, they are well suited to the needs of the wearers, and as little open to objection as many other customs which our state of civilization renders it necessary to follow. While we cannot indorse very strongly the much-abused and universally-worn corset, yet it is an anatomical fact that in women the upper part of the lungs is used in breathing to a much greater extent than in men, where the inflation takes place lower down in the chest, so that the interference with the breathing is much less than is generally supposed. The corset may not be a healthful article of dress, but its fatal effects are often postponed for seventy or eighty years.

In hygienic matters, as in every thing else, the best guide is an average amount of common sense. Life has been described as "a disease exceedingly contagious and invariably fatal;" and, as long as we can keep tolerably comfortable under the affliction, it is worse than useless to worry and fret lest we are not giving ourselves the proper "treatment," or to make ourselves miserable in futile and irrational attempts to postpone the inevitable end.

—•—

EXERCISE AND RECUPERATION.

There is an important fact concerning exercise which is familiar to the physician, but not understood as it ought to be by non-professional folk. It is a popular error, that the aim of exercise is solely or mainly to *work* the muscles or the organ that is put in action. This is, indeed, important in itself, for obvious reasons; but there is another purpose in exercise, and that is, to stimulate the "faculty of recuperation," as it has been called. Whether it is a faculty in the strict sense of the term, as those who believe that nutrition is under the control of a special system of nerves would call it, does not matter. No one will misunderstand the meaning of the expression as we use it here.

Unaccustomed feats of strength, whether of muscle or of mind, are "exhausting," we say; and this is due to deficiency or want of vigor in this faculty. The work has been performed, but the recuperative nutrition does not promptly follow. The part which has been exceptionally exercised has suffered loss which is not immediately made good. It has been equal to the demand made upon it; but, if the demand is soon repeated, there is not the same ability to meet it. There is a great difference in persons in this respect, as every one knows; but it is not always a difference in absolute strength. Of two men of equal muscular power, one may be able to "hold out" in a given exercise or kind of work much longer than the other. The one, for example, can perhaps walk ten miles without exhaustion, while the other gets completely tired out with two miles; or the one, after walking ten miles, and then resting an hour, can start off and walk another five miles or more without fatigue, while the other cannot renew the effort for the rest of the day. In this latter case we sometimes say that one man has more "elasticity" of strength than the other, and the metaphor is an apt one. He has suffered a certain strain, but, like a highly elastic substance, returns readily to the normal condition when the strain has ceased.

Now, the difference between being accustomed to work "without feeling it," and being "used up" by it, and the difference between the prompt and the slow rallying from fatigue, is the difference between the power of rapid repair by nutrition, and the absence or deficiency of that power; and the aim of exercise is to develop or strengthen the power. What amount or degree of exercise will best accomplish this result? It is a common mistake to do too much. People suppose that the more they can do before getting exhausted, the better, and so they persist in the exercise until they are thoroughly exhausted. But exercise with a view to gaining the power of recuperation should never be carried so far as to exhaust the nervous energy. No marked feeling of fatigue should be produced. If exhaustion is experienced, the exercise has been excessive, and defeats its purpose.

In athletic "training" this principle is invariably recognized. The ambitious youth who is eager to exercise overmuch, from his impatient desire to gain strength and outdo others, is admonished to limit himself to the precise amount of exercise directed; and this amount is gradually increased as he becomes able to go through it without extreme fatigue. And the man who is his own "trainer" should be governed by the same principle. He should begin with a moderate amount of work continued for a brief period, and be guided in the increase of exercise by the readiness with which he recovers from the fatigue, and regains the power of comfortably renewing the effort. The common mistake is in seeing how much one can do before getting exhausted; the aim should rather be, to see how much one can do and yet rally from it after a brief interval. And this recuperative power must be the genuine recovery due to rest, and plain, nutritious food, not the delusive renewal of vigor which follows the use of stimulants. If a man finds it necessary to resort to stimulants after work or exercise, that very fact shows that he has kept up the exertion too long.

If the principle we have attempted to explain were kept in mind and followed in practice by those who desire to gain strength by exercise, there would be fewer failures than generally attend the unintelligent endeavor in that direction.

—•—

Linseed Meal for Poultry. — A French poultry-raiser claims that the flesh of animals, especially fowls, fed upon linseed cake, is indigestible, and of a bad flavor.

MONTHLY SUMMARY OF MEDICAL PROGRESS.

COMPILED EXPRESSLY FOR THE SCIENCE NEWS BY W. S. WELLS, M.D.

Dr. Bloebaum of Coblenz read a paper at the late Medical Congress held at Weisbaden, advocating the use of the *Galvano-Cautery* in treating *Diphtheria*.

He found that the application of the red-hot platinum-wire, even without the use of cocaine, caused very little pain; that the cauterized sores were totally sterilized, the fever disappeared, the membranes did not re-form, and no local inflammation followed the burning. These results he obtained without the aid of antiseptic or antithermic medicines; and so confident is he of the efficacy of this new mode of treating diphtheria, that he believes the number of fatal cases will be reduced to a minimum if the patients are treated in the proper manner, without loss of time, by the platinum loop. Professor Nussbaum and others expressed a favorable opinion of the method.

Professor Schwimmer, in the *Wiener Med. Woch.*, mentions some experiments at his clinic in the cure of *Fissures of the Tongue*. In some persons, especially where gastric disturbances are present, the tongue suddenly becomes fissured all over, without, however, becoming coated, changing its color, or losing moisture.

The professor tried, without benefit, chromic acid, as recommended by Vidal; iodoform, as used by Dr. Huna of Hamburg; and Kaposi's plan by nitrate of silver. Lactic acid, as employed by Schiff, gave the patients decided relief, and in one case almost effected a cure.

Finally Schwimmer used *Papayotin*, and the result was surprising. In every case an amelioration was at once noticed, and within a few weeks a perfect cure resulted. He used it as follows: papayotin, one to two parts; distilled water, glycerine, each ten parts. This solution was applied with a camel's-hair brush from two to six times every day, after the parts had been previously well dried. The effect is not a macerating one; but it acts by stopping the pain in the parts deprived of their epithelium, and causes a renewal of the latter.

In twenty-five cases, many of which were of many years' duration, a complete and permanent cure was established in all, with the exception of one where a syphilitic dyscrasia existed, but where specific treatment had been of no avail; even in in this case a great amelioration was obtained.

M. Poucet communicated his views to the Freuch Congress of Surgery regarding a process of reconstructing bone by means of *Osseous Grafts*.

It is not after cicatrization that the grafting can be expected to succeed, but anterior to that period, when active healing of the parts is in progress. In the case of a child eleven years of age, from whom a long sequestrum of the tibia had been removed after osteomyelitis, grafts composed of four bony fragments were procured from a young kid, and implanted in the fleshy granulations, where the tibial sequestrum had beeu.

Antiseptic dressing was used, and the limb kept at rest with plaster splints. Six months after the operation there was a solid bony mass thirty centimeters in length, and the child was able to walk.

Alexander Harkin, M.D., F.R.C.S., gives a very iuteresting and able paper on *Nocturnal Eneuresis*, in the *Provincial Medical Journal*, England. He gives a review of the methods proposed by various prominent practitioners from time to time, showing their multiplicity, contrariety, and often contradictory nature, and goes on to show, that, to

form a correct estimate of the conditions to which nocturnal enuresis is due, it is necessary to keep in mind the relations of the kidneys, bladder, and urethra with the higher nervous centres, especially with the medulla oblongata. His mode of treatment of enuresis is founded upon the theory of a hyperæmic condition of the medulla oblongata, — an actual congestion of this portion of the brain which presides largely over the urinary and sexual organs; and he relieves this congestion by cupping and blistering the nape of the neck, applied as high as possible and as close as practicable to the neighborhood of the foramen magnum occipitale and the region of the medulla oblongata.

In his experience he has not always had to resort to the cupping, one full vesication alone being generally sufficient ; a blister three inches in length by two in breadth, either emplastrum lyttæ, or, as he prefers, the linimentum cantharidis of the Pharmacopœia, applied with a brush, painted vertically, and exposed till dry.

It is very seldom that a second application is required; but occasionally, especially in females, after some months of respite, there may be a call for renewal of the blister.

In obstinate cases, and in adults, dry or wet cupping may be requisite to complete the cure.

It is claimed by Dr. Don F. Rivas, in *La Union de las Ciencias Médicias*, that cases of *Malignant Pustule* have been rapidly cured by the application of a paste composed of quinine and oil of turpentine. One of the cases was that of a shepherd, in whose flock the disease had appeared, and was supposed to have been communicated through the sting of a mosquito upon his forehead. Two hours afterward the head and neck were extremely œdematous.

The paste was applied, and the pain and swelling shortly diminished. A couple of days later a large quantity of sanguinolent fluid was discharged, and by the fourth day the man was quite well.

Another case was that of a woman who had a malignant pustule on her hand, which was unaffected by various remedies which were applied; but, on the application of the quinine and turpentine paste, the severe pain ceased almost immediately, and the œdema rapidly diminished, the patient being quite restored to health in four days thereafter.

The *Deutsche Med. Wochenschrift* reports the case of a tanner who was taken suddenly ill with anorexia, griping, and mental oppression, followed later by a severe epileptic fit. A saline purgative administered to the patient caused the passage of several thousand *Larvæ*, or grubs of flies.

Upon their discharge the attack at once ceased, and the patient recovered. The journal named considers the case important, as placing beyond doubt the possibility of symptomatic epilepsy due to entozoa, which has been disputed; and further, that it demonstrates the danger of the ingestion of cold meats, left where they can be reached by flies. The ova are deposited on the meat; and, unlike the meat, they are not affected by the action of the gastric juices.

In cases of persistent *Nasal Hemorrhage*, Professor John Chine of Ediuburgh advises that plugging the posterior nares should not be done until an attempt has been made to check the hemorrhage by firmly grasping the nose with the finger and thumb so as to completely prevent the air passing through the cavity in the act of breathing.

This simple means, if thoroughly tried, will usually arrest the bleeding, by allowing a clot to form at the site of the ruptured blood-vessel. The finger and thumb should exercise pressure enough to prevent breathing through the nose for some time: and, when removed, the patient must avoid trying to blow the nose; otherwise the air, being driven through the nostril, may dislodge the clot. If the air is prevented passing through the nostril, the clot consolidates, and the hemorrhage is arrested.

The process is revived of applying strips of adhesive plasters along the margins of wounds, and by drawing the edges of the wound in apposition, pass the sutures through the plaster only, thus avoiding the pits and creases left in the skin when the sutures are passed through the skin itself. The edge of the plaster along the margin of the wound should be folded upon itself, so as to keep the plaster from the raw surface.

The *British Medical Journal* says, Dr. Mial has used tannin for ingrowing nails, and does not find it necessary to enjoin rest. A concentrated solution — an ounce of fresh tannic acid dissolved in six drachms of pure water, with gentle heat — is used, by painting the irritated soft parts twice a day. Two cases recently had no pain or lameness after the first application, and went about their work immediately, which they could not do before. This painting with the tannin is to be continued until the nail has grown to its proper length and breadth. No other treatment was necessary.

The *London Lancet* mentions the case of a woman, *enceinte* (eighth month), admitted to hospital suffering from acute pneumonia, — whole of left lung, — with a history of illness covering the four days previous to admission.

On the evening of that day her temperature was 103.6° F., and she was delivered of a female infant, which died in less than twenty-four hours after birth, with symptoms of acute pneumonia. A post-mortem examination showed acute pneumonic consolidation of the whole left lung. The mother made a rapid and good recovery. Attention is called to this peculiar and rare transmission of "acute pneumonic fever" by the pregnant woman to her offspring, yet *in utero*, although the transmission of some other diseases has been recorded.

A REMARKABLE RECOVERY FROM A WOUND IN THE HEAD.

Editors Science News :

I was an eye-witness of the occurrence related in the February number, where an iron bar penetrated the brain of a man without fatal results. It occurred in 1848 in my native town of Cavendish, Vt., while the man was working on the railroad just below the village. He was tamping down a charge with an iron bar which was both tamping-iron and drill, with a "belly" near the middle about an inch and a quarter in diameter. During this process the charge exploded, the drill end being uppermost; it entered the upper maxillary bone, and passed up through the brain, coming out near the union of the parietal bones. The bar crossed the track of the optic nerve, and was supposed to have cut it off, or injured that part of the brain where it takes its rise, as the sight of one eye was destroyed.

The man was brought to the hotel in a wagon, and walked upstairs by himself. The physicians who attended him concluded not to adopt any active treatment beyond dressing the wound. The accident occurred in September, and the next May I saw him walking on the street at Cavendish. Dr. Harlow, who attended him, resides at present, or has resided for the past twenty years, in the town of Woburn, Mass. It was a most remarkable case, and I would not have believed it if I had not seen the man myself.

C. A. Scott, M.D.

Tyson, Vt., *Feb.* 21.

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ONE DOLLAR A YEAR, IN ADVANCE.

SETH C. BASSETT,
MANAGER.

Publishers' Column.

What time is often wasted in deciphering signatures! Remedy, care and an Esterbrook Pen.

Physicians should send for the convenient and comprehensive Syringe manufactured by the Tyer Rubber Company of this city.

The best substitute for a morning bath is a thorough rubbing with one of Dr. Waters's Flesh-Brushes. It is both cleansing and invigorating.

Baltimore, Jan. 20, 1875.

I certify that I have used Colden's Liquid Beef Tonic largely in debility, febrile and nervous diseases, and that I have found it one of the most reliable of our nutrient tonics now in use or to be found in pharmacy.

John J. Caldwell, M.D., 71 North Charles St.

Ice Machines and Refrigerating Apparatus are most needed in the summer months. Orders sent to David Boyle of Chicago can be filled before the hot weather, and the machines will be found more effective and economical than those of any other make.

For Sale. — A Troemner No. 3 Assay Balance, nearly new and in perfect order. Sensible to one-hundredth of a milligram. Also two sets of assay weights, English and metric systems. Will be sold at a bargain. Address Popular Science News Company, Boston, Mass.

McArthur's Syrup of Hypophosphites is becoming a standard medicinal preparation, and is constantly gaining in favor among the large class of physicians who use it in their practice. Where the use of phosphorus is indicated, it will be found a most elegant and effectual form for its administration.

Mellin's Food is a dry powder made from wheat and malted barley. By a careful, scientific process, the indigestible portions of the grain are extracted, and the entire starch property is converted into dextrine and grape-sugar by the action of the malt diastase. Thus the greater part of the work of digestion is performed before the Food reaches the stomach.

Our readers who contemplate paiuting this season, whether indoors or outdoors, will do well to inform themselves as to the merits of the U. S. Gutta Percha Paint, manufactured in Providence, R.I. The evidence is, that better and more durable work can be done with it than with any other paint. The increasing trade the manufacturers are having is evidence of its growing popularity.

Dr. W. W. Gardner, Springfield, Mass., says: "It seems almost tautological to recommend Horsford's Acid Phosphate, a valuable local and stomach tonic. I have made use of it in my family and in practice for years. I will, however, repeat what my practice confirms, — that I value it, when taken according to directions, as an excellent preventive of indigestion, and a pleasaut acidulated drink when properly diluted with water, and sweeteued."

We are sure many in the profession and many out of it have already become familiar with Hydroleine, so long and successfully manufactured by William F. Kidder & Co. Hydroleine has a special advantage over its rivals, in the fact that it readily mixes with water, or almost any menstruum, an advantage which will be readily appreciated by those who prescribe cod-liver oil in the various maladies to which it is adapted. Our personal experience with this preparation has been extensive, and in every case highly satisfactory, not only to ourselves, but also to the patieuts for whom it has been ordered. — *Med. Bulletin.*

The Popular Science News

AND

BOSTON JOURNAL OF CHEMISTRY.

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CONTENTS.

FAMILIAR SCIENCE. — John Dalton 63
Field Geology 64
Natural History Notes 65
Popular Errors in Meteorology 65
A Wise Wasp 66
The Strength of Snails 66
Scientific Brevities 67

PRACTICAL CHEMISTRY AND THE ARTS. — Artificial Ice-Making 67
A Portable Signalling Apparatus 67
A Magic Compass 68
Cotton-Seed Oil in Olive Oil 68
Practical Receipes 68

HOME, FARM, AND GARDEN. — The Mysteries of Plant-Growth 69
Origin of Cattle 69
Oleomargarine under the New Law 70
Selected Receipes 70
Household Hints 70
Gleanings 70

EDITORIAL. — Solution 71
Tungsten 72
Meteorology for March, 1887 72
Astronomical Phenomena for May, 1887 73
Paris Letter 73
Fires from Steam-Pipes 74
Butter-Testing 74
Questions and Answers 74
Literary Notes 74

MEDICINE AND PHARMACY. — Some Facts concerning the Human Brain and Mental Phenomena 75
Pain and its Uses 75
Distilled Water in Eye Lotions 76
Monthly Summary of Medical Progress 76
Poisoning by Poison Oak and Poison Vine 77
Effect of Change of Climate upon Indians 77
A Movable Sheet for the Sick 78
Medical Memoranda 78
Humors 78

PUBLISHERS' COLUMN 78

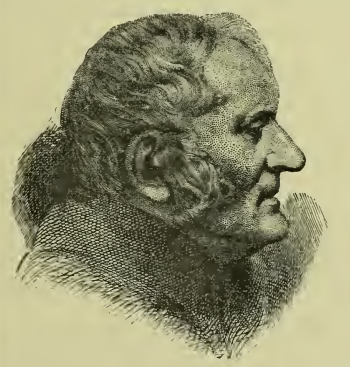
Familiar Science.

JOHN DALTON.

THE subject of this sketch was one of the most noted of the early chemists, and is especially distinguished for his discovery of the combining numbers of the elements, and as the founder of the atomic theory of chemistry, which is as important to that science as the development theory is to biology. He was born at Eaglesfield, in England, Sept. 5, 1766. His parents were in humble circumstances, but he managed to obtain a fair education. From his fifteenth to his twenty-seventh year he was engaged in school-teaching and continuing his studies in mathematics and science. In 1793 he was appointed instructor in those branches in the New College of Manchester; but on the removal of that institution to York, in 1799, he resigned his position, and became a private tutor, and for the remainder of his life was constantly occupied with his studies and experiments.

Dalton was especially interested in meteorology, and one of the last acts of his life was to record an observation. He was afflicted with the now familiar affection of color-blindness, being entirely red-blind, and was the first to bring the matter to public notice, in a paper read before the Manchester Literary and Philosophical Society. He also read numerous other papers on various scientific subjects, in one of which he foreshadowed Faraday's discovery of the reducibility of gases to liquids by compression, and the law enunciated by Gay-Lussac six months later, — that gases expand proportionally to their temperature.

But it is upon his discovery of the combining proportions of the elements that his fame chiefly rests; and, so far as we know, no attempt has ever been made to dispute his right to the discovery. The first hint of this appears in a paper upon the constitution of the atmosphere, written in 1802, in which he says: "The elements of oxygen may combine with a certain portion of nitrous gas, or with twice that portion, but with no intermediate quantity." But in 1803, at the end of a paper upon the



absorption of gases by water, he first speaks of his discovery, and explains it by the same theory as is held at present, — that the proportions, by weight, with which the elements combine with each other, are the actual weights of ultimate particles or atoms of matter: and in a work published in 1808 he makes the distinction, although not very clearly, between the ultimate particles of simple and compound bodies; that is, as at present understood, between the atom and the molecule.

We give a few of the atomic weights first obtained by Dalton, with the correct weights, according to the old notation, in the third column. Although it will be seen that they are far from correct, yet the great law of chemical combination had been discovered, and the theory of atoms originated by Dalton has undergone but little change since he first brought it forward.

Element.	Atomic Weight according to Dalton.	Correct Weight.
Hydrogen,	1	1
Nitrogen,	4.2	14
Carbon,	4.3	6
Oxygen,	5.5	8
Phosphorus,	7.2	31
Sulphur,	14.4	16

Considering how little was known about the science of chemistry at that time, and the imperfect apparatus with which the experiments were made, it is surprising that these numbers were even approximately correct; but Dalton was not remarkably skilful in manipulation, and he was inclined to make the facts fit his theories, rather than to subordinate his theories to the results of his experiments. Still, the table given above is certainly the result of a most remarkable scientific generalization, and is of equal importance with Lavoisier's discovery of the laws of combustion, and overthrow of the phlogiston theory.

In 1837 Dalton was seized with an attack of paralysis, from which he partially recovered, but the following year received a second shock. Although much enfeebled in body and mind, he survived until July 27, 1844, when he was found lifeless in his bed, and a few days later was publicly buried at the cemetery of Ardwick near Manchester.

Dalton, like many other close students, was awkward in society and reserved in manner. His work was rather of the head than of the hands. Sir Humphry Davy says of him: "Memory and observation were subordinate qualities in his mind; but he followed with ardor, analogies and inductions: and, however his claims to originality may admit of question, I have no doubt that he was one of the most original philosophers of his time, and one of the most ingenious." He never married, having, as he said, "no time" for such matters: but his lack of means in early life was probably the real reason. In 1826 he received the well-deserved honor of the medal of the Royal Society, for his development of the atomic theory; and in 1833 a public subscription was taken in Manchester for a bust of the great chemist, which was placed in the entrance-hall of the Manchester Royal Institution.

Dalton was evidently a firm believer in the actual existence of the atoms whose weight he first determined; and although his theory is almost the only one by which we can explain the laws of chemical combination, yet the tendency of modern times is rather against a literal interpretation of the theory. Although the so-called atomic weights are evidently the weights of *something*, yet it is rather difficult to believe them to represent the relative weights of actual particles, which, although possessing definite volume and weight, cannot be subdivided, but are ultimate and absolute manifestations of matter. Professor J. P. Cooke says on this point: —

"Although, in the present state of the science, it gives essential aid both to investigation and study, I have the conviction that

it is but a temporary scaffolding around the imperfect buildiug, which will be removed as soon as its usefulness is passed."

When one who has been called "a blind partisan of the atomic theory" holds to such conservative views, it is well to wait for more light upon the subject before believing that Dalton's brilliant hypothesis, which has been of such incalculable service to the advance of chemistry, is an expression of an absolute truth as regards the constitution of matter.

[Original in *Popular Science News.*]

FIELD GEOLOGY.

BY PROFESSOR N. S. SHALER.

There is a common notion that geology is a special science, which demands a peculiar training; that it cannot be followed save by those who have devoted their lives to its study. This is an error. The truth is, that the earth-science is not one distinct branch of learning, but a bundle of very diverse kinds of information, some of them abstruse, and demanding a peculiar training in those who would make use of them; others, and by far the most important, requiring far less book-knowledge or scholarly training than the intelligent observer in any other branch of science has to use. Common sense, allied to an interest in nature, will, with a little reading and much practice, make any one competent to interpret the simple phenomena of the earth. There is so much of profit, and of pleasure as well, in the work of interpreting the structure of the earth which lies about our doors, that I venture to ask the reader to consider with me the way in which he may approach the delightful task without having to become a geologist in any laborious way.

At the outset of his efforts, the student should clear himself of the notion that he must tread all the paths of geological inquiry at once. He should see that in the body of the earth, just as in his own frame, there is a vast array of diverse actions going on at the same time. Some of these bodily processes are simple, indeed, — the most important of them are the easiest to understand; others demand the most intimate and accurate inquiry for their explanation.

In the study of the physiology of animals we may observe particular functions, neglecting the vast remainder of the actions which affect the animal's life. In the study of birds we may consider their plumage or their habits alone; in the study of the earth we may limit our inquiries in a similar way.

The beginner in geology will do well, at the outset of his studies, to limit himself to that part of the geological field which concerns the process now in operation, or to that portion of the science commonly known as surface geology. Whatever else may be wanting in the field in which the observer resides, he is sure to have in the surface of the earth about him a realm in which his inquiries may take a wide range. He is almost sure to have near him some stream considerable enough to develop the phenomena of rivers; some lake which will show him the effect of the contact of a water surface with the shore; or, better still, he may have access to the sea-border, in which case he has at command a wide range of phenomena of the most interesting description. The beauty of this field of the earth's surface is, that there we see the processes of geological change in their active state. When we go beneath the crust, we enter on a realm where the geological forces have either ceased to act, or operate so slowly that we cannot perceive the nature of their work save by their effects. On the surface we may observe important geological operations, proceeding with such speed that from hour to hour or from day to day, or at least from year to year, the results of the work are observable.

At the outset it will be well for the studeut to consider whence comes the force which is operating on the earth's surface. Let us suppose that he is studying the action of rain, and that he follows it from the time the drops come to the surface, through the stages by which they are gathered into rills, then into brooks, and finally into the larger streams. Let him, in the first place, consider the process by which the rainfall comes upon the surface. Let him, in imagination, behold the sun's heat falling upon the surface of the sea, and, by the warmth which it gives to the water, and the air which lies upon the ocean, producing an evaporation which forms a cloud. Let him conceive this cloud borne by the winds, which are themselves the product of solar heat, until it comes over the surface of the land, and gives forth the water as rain. He will thus perceive that the gravitative energy of the falling drop is due to the solar force which has lifted it to its height in the cloud.

Next let him note the effect of falling rain on the surface of the earth. Where the drops come upon a surface covered by vegetation, the living plants, or the mat of decayed vegetation which lies above their roots, protects the earth from the blow of the falling rain, aud so the soil is uot disturbed; but where the rain falls upon the tilled field, it is evident that the blow of the drops produces decided effects. It breaks up the soil, — in part dissolves it, and in part conveys the fine grains away by the splash which it produces. It forms the soil into the tiny rivulets which abound on any surface which is not covered with vegetation. Wherever a small, flat stone lies upon such uncovered soil, protecting the surface from the force of the falling drops, a little column is formed, capped by the resisting object; the height of these columns gives a measure of the erosion accomplished by the rain.

Following the course of the water from the impermanent streams, which exist only while the rain is falling, to those of larger size, we observe the action of their currents upon the *débris* swept into them by the storms. Often a small brook, if it be not too steep in its descent, will exhibit to us the phenomena which give rise to the alluvial plains which border all rivers. We may perceive, from hour to hour, how the rivulet is compelled to swing to and fro by the embarrassing *débris*. In the course of a day's observation we may see, in miniature, all the important phenomena indicated in a small way in the beds and banks of the streamlet, which are shown on a larger scale in the Mississippi River. Following the course of such a small stream, we almost always find considerable variations in the declivity of its bed. These variations give us a measure of the wide range in the carrying-power of the current, which arise from the differences in the speed of its motion. Where the slopes are lowest, the current is unable to carry any material coarser than mud; where they are greatest, we may find pebbles of considerable size borne along with considerable rapidity. Besides these above-noticed phenomena of current action, such streamlets afford, in miniature, illustrations of many important points in the geology of rivers. Where there is a little lakelet, we may observe all the phenomena of delta formation. Here and there we find an "ox-bow" cut off where the stream, having described a great bend, finally makes its way across the narrow part of the bend, or bow, leaving the old, abandoned section of its bed in a sickle-shaped lake. As the little stream cuts its channel, deeper alluvial terraces, essentially like those on the Connecticut and other rivers, are left on either side. These, and many other phenomena which the student will do well to search for, are shown in the smaller brooks of any country after a considerable fall of rain.

In all his observations, the student should have constantly in mind the fact that he is dealing, though in a small way, with the largest and most important of the geological forces, — the erosive force which has shaped our lands, and which has provided, from the remotest ages, the sediments by which deposits are made on the sea-floor.

It will be well, in connection with the observations of streams, to examine a little into the action of that part of the rain-water which does not flow over the surface, but penetrates for a greater or less distance into the earth, and emerges in springs. It is easily seen that the water which comes forth from a spring differs from that which has coursed over the surface of the soil, iu that it is perfectly clear; while the superficial water, at least after a storm, is turbid. At this point it will be well for the observer to make a small experiment. Taking a quart or more of rain-water which has not touched the earth's surface, and an equal amount of water from some permanent spring, he should evaporate this water by boiling. When the two vessels are quite dry, he will perceive that the rain-water has left no residue, while that from the spring affords a more or less considerable quantity of solid matter. This solid matter has been removed from the earth and rock through which the spring-water flowed, and so is contained in the transparent fluid in the form of a solution; that is, completely dissolved in water. He thus will be brought to perceive that the underground water does work of erosion, as well as the superficial streams, but that the underground water creeps through the rocks, and, on account of the slowness of its motion, exercises no rending power. It takes away only materials which it can completely dissolve; while the superficial stream, moving rapidly, rends the surface, and so comes to possess a greater current of undissolved solid matter.

If the observer has a mind to carry his studies on river-erosion one stage farther, he may make a rough estimate of the amount of material carried away by the stream and borne out by the spring-waters from a given square mile of territory in a given time. He will thus come into possession of data of distinct scientific value, from which he may compute the rate at which the surface is sinking; i.e., the rate at which the surface he is examining is being worn down towards the sea-level. To make such an estimate with approximate accuracy demands a little skill and patience on the part of the student, but the inquiry affords an admirable basis for training in the art of observation.

Supposing that the student has access to the shores of a large lake, or, better still, to the sea-coast, he may extend his inquiry into the processes of erosion by the study of that action in a different form. The principal part of the erosive work done on sea-margins is accomplished by the action of the waves. These waves are, as is well known, due to the friction of the winds upon water. This friction causes the water to undulate; aud these undulations break against the shore, applying to the point at which they strike, the force which they have gathered from the actiou of the winds from the wide surface of water. The student should first note the extremely varied effects of these waves on shores of diverse character. Where the shores are steep and rocky, the waves act by hurling, against its base, fragments of loose stone which have fallen from the cliff. By the successive blows which these wave-tossed stones inflict, the cliff is

undermined. Its overhanging part is borne down by the gravity, affording new fragments for the waves to use in their assaults, as rapidly as the old is worn out by the pounding which it receives. On other parts of the coast we find beaches; these beaches are composed of the fine sand worn from the cliff-sections of the shore, and accumulated in the bays into which it is driven by the action of the waves. On these beaches it may be noted that the surges roll the fragments to and fro, grinding them against each other in such a fashion that they are slowly worn to powder.

Besides these general facts, the student may observe, on any shore, a host of minor phenomena. On the beach he may well note how the sand is protected from the blow of the wave by the thin layer of water which capillary attraction holds between the grains, and which prevents the blow of the waves from grinding them against each other. He may also note how a portion of the sand, dried in the sun, and blown by the winds, escapes from the beach, and, in the form of dunes, marches inland across the land. He may often find these moving masses of sand many miles inland from the shore whence they were derived. On the cliff portions of the coast he may note the surprising differences in the rate at which the rocks yield to the blow of the waves, whereby a rocky coast generally becomes extremely diversified in outline. He may profitably inquire into the features of the rock structure which causes these wide diversities in the rate of erosion effected on the coast by the sea. The foregoing suggestions will afford a basis for an inquiry into the nature and process of erosive actions, but they suggest only a very small portion of the facts which may be observed. If the student will follow these indications, he will acquaint himself with the method of inquiry which needs be applied to the phenomena; and he will certainly, in the course of these observations, come upon a host of questions which he can proceed to consider from his own motive.

In such inquiries, the young naturalist will do well steadfastly to keep in mind the origin of the forces which are operating beneath his eyes. He should endeavor to proceed from the most general aspects of his problems towards more detailed considerations. At every stage of his work he should indicate what he sees by careful notes, and he should help himself in seeing by ceaseless efforts to delineate the effects in a graphic way, both by drawings, which will show as nearly as possible how the things look, and by diagrams, which will indicate how he perceives the results to be brought about. Where the person cannot draw well enough to make a picture, the graphic element of the notes may be omitted; but diagrams — that is, combinations of lines intended to indicate how the forces act — can be made by anybody; and the effort to make them, especially if they be made again and again as the student advances in his considerations, will be of very great help to him in attaining the methods of scientific observation.

(To be continued.)

NATURAL HISTORY NOTES.

BY DR. S. F. LANDREY.

V.

A neighbor caught an otter in a trap built of logs and saplings. He did his best to escape, but signally failed. The head was presented to me for inspection. He must have been very persistent and determined in his efforts, for all his incisors and canine teeth had not only been broken off trying to gnaw out, but even the alveolar processes, some of them, had been broken down to half the depth of the alveolar sockets. Love of life and liberty in the otter seems, from this one fact, to be more strongly developed than in most other animals of the order *Carnivora*, when he determined to escape at the expense of skin, flesh, teeth, and bone, with all the entailed suffering included which the loss of these implies. If in man, endowed with an immortal principle, these traits of character are commendable, why not respect them in an animal "whose spirit goeth down to the earth"?

My little dog had followed me on several occasions when making trips to the country, chasing pigs, chickens, etc., by the way, to my annoyance. I ordered him shut up a few times. But what amused me another time was, to see him run, jump over the fence, and disappear just as I ordered the boys to shut him up. The horse was harnessed and hooked up, when, on looking down the street a hundred yards away, there lay the dog waiting my approach. He was permitted to follow, but his manners were more subdued and obedient. It continued his invariable custom, however, to disappear when the buggy was brought out, and when, some yards from the house, he would reappear. He certainly dreaded solitary confinement, and loved freedom and fresh air better than village pleasures. He knew just how to secure the purpose in view, for he always lay where he could see just which road was taken out of three.

A gentleman who left this village some years ago, and went to Michigan to engage in lumbering in the pine region, recently returned. In his conversation he related a fact not commonly known about bears. He sighted one distant about one-fourth of a mile. Cautiously approaching within good range for a Winchester rifle, about two hundred yards, he fired. He says he is positive the bear never saw him, but started directly *toward* him, where he was perfectly concealed. He continued firing till it approached within twenty-five yards, when the fifth close-range shot caused it to fall. On skinning it, the last shot he found to have made an opening through the heart and lungs on both sides, large enough to thrust in his closed hand. Three were killed; and every time, though perfectly concealed, the wounded bear would start toward him in as direct a line as if he had seen whence the shot was fired. How they knew, he did not ascertain.

An educated Indian preacher made a statement in a public lecture here, that, while it may be true, I have had no opportunity yet of verifying, — that an Indian in his wild state is the possessor of two coats of hair on his head. The first coat, he says, is the one he brings with him at birth; the other coat commences at about ten years of age, and at maturity is fully developed. Where no head-dress is worn of any kind, in the wild or blanket Indians, he says the hair of the two coats grows together in a sort of matted form. His own head showed distinctly a fine and coarse hair on the same head; but this I have often seen in white people, where the parents had somewhat similar temperaments, but with a strong sanguine element in one, and a bilious element predominant in the other. Another fact is noticeable. The cultivated Indian has not the erect appearance of his uncultivated brethren. He appears humbled, and his look is oftener earthward.

Some cats will not only jump high enough to rattle a latch or touch a door-knob when they desire to gain an entrance to a house, but have even been known to exhibit intelligence enough to push open a door, or raise a latch and open it, as effectually as a human being could perform the same feat. I once knew of a goose that would spring up and catch the string attached to an inside wooden latch, open the door, and walk in to the fire as deliberately as any one of the family. To him the latch-string was seldom out, except by way of experiment. It could hardly be said of him "as dumb as a goose."

Cats are full of curiosity; and if a new chair or other piece of furniture is brought in when they are out, as soon as seen, they walk around it, smell of it, and touch it, — sometimes climb up on it, sit awhile, and go off satisfied. When hungry, they lick out the tongue, elevate the tail, and follow some one around, or pull at the clothing of the arm, or lap to attract attention to their wants. When satisfied with eating or with drinking, the tail is lowered. Scratching at the door is their sign for wanting to go out, also. The same sign on the outside indicates a desire to get into the house. If the door is partially open, "special pleading," in a cat's way, to get in, is shown by a protrusion of the tongue beneath the nose, or a look and a gentle mew.

Shaking the head or jerking the foot is not only an effort to free the foot or ears from water, but is a sign of disgust or dislike, — the degree measured by the energy of the action.

Rubbing the head is an effort to attract attention, as well as a sign of friendship and familiarity. Purring is an emotional satisfaction or an anxiety. A large yellow cat of ours used to follow the servant to the meadow, sit on a log till the milking ended, and return with the milker, — a case of clear selfishness, for he wanted milk, and always received it.

To whistle like the bob-white will sometimes bring the calling bird to its imitator, especially if the latter be well secreted where he cannot be seen. As a boy, I used to indulge in this sport occasionally, just to see how far the plan could be made successful. A dove can seldom be drawn nearer than a hundred yards, and oftener not so close even as that. Take the two notes, lower *do* and *me*, on the F scale, and you have the dove's notes, when you put in the intermediary eighths. Wild turkeys are easily called, under proper circumstances, with a proper tube, or with a hollow wooden cup with a steel stem angled at the end, held loosely in the hand, and drawn in short, screaking catches over a common whetstone. But animals and birds do not like imitators any better than do men. An oriole, or fire-bird, visiting my premises, I ventured to whistle as nearly like him as possible. He was some distance away; he came nearer and nearer with each effort, till near enough to see the source of the imitation, when he left in a seeming temper, for he did not venture there again for a year.

A rooster standing in the lot, looking around, put me in mind of trying the effect of imitation on him. I crowed; he hesitated, gave a low chuckle, then crowed too. I crowed again, and he answered. I now slapped my sides, is if flapping my wings for a fight, and crowed. He was mad — mounted the hen-house, flapped his wings, crowed loudly, and looked as if he would say, "If you are spoiling for a fight, come on, for I am ready." It was fun for some boys who witnessed it. The rooster took the hint, and no further efforts could induce him to repeat his foolishness.

POPULAR ERRORS IN METEOROLOGY.

From a lecture delivered by Mr. Cleveland Abbe before the Franklin Institute of Philadelphia, and reported in the *Journal* of that society, we make the following extracts: —

"Let us then recognize that in general the atmosphere is governed by immutable laws, and seek

for the forces that control it. Almost any one of us here, at the present time, would naturally say, the heat of the sun is the most important factor: and yet, strange as it is, there are millions who to-day are studying the moon and stars; or rather, they are basing their every-day lives upon weather predictions published in the almanacs made up sometimes several years in advance by means of ancient astrological principles, whereas the plainest teachings of the real science of meteorology go to show that the influence of the moon, the planets, and the stars upon our atmosphere is wholly inappreciable. It is vain to shut our eyes to the fact that Wiggins, Vennor, Capen, Foster, and others in this country, and the Shepherd of Banbury in England, have a hold upon the credibility of the masses wholly unjustified by the value of their predictions, and are actually doing more harm financially than would cover the cost of all the government weather bureaus in the world. Of all the heavenly bodies, except the sun, it may be safely said that the moon is most likely to have some slight influence on our atmosphere; but every effort to demonstrate such influence has so signally failed, that we may say, with an astronomer of a hundred years ago: 'The moon *ought* to have an influence on the weather, but it *hasn't*.'

"We have, however, in those little dark spots that appear on the sun's surface, a suggestion that has been worked up and overdone by very many; thus, we have one who stoutly maintains that the appearance of any special 'sun-spot' enables him to at once predict a corresponding special storm or weather. This idea has been arrived at, apparently, by a complete violation of all laws of logic. Areas of stormy, or cold, or hot, or windy weather, are so frequent all over the earth, and spots on the sun are so frequent, that it is always possible to pick out a number of coincidences in time; and the style of logic that demonstrates a certain storm to be casued by a certain spot, would equally well be applied to demonstrate that my body is warmed by the mass of hot coals in the fireplace, while my cold hands are due to one special coal that will not burn as brisk as its neighbors.

"A singular belief has been handed down to us from remotest ages, to the effect that the animals, in their natural state, know more about the future weather than does man himself; and this idea has apparently grown out of the study of the habits of migratory birds and hibernating animals, all of whom do really seem to foresee the approaching seasons, at least in a general way. It certainly has required the best power of the speculative naturalists to explain how such birds, for instance, as the wild duck or the swan, ever come to think of making their long annual flights. We see the Indian go from the sea-shore and a marine diet in winter, to the forests and flesh diet in summer (or we see the modern American reverse this process), and we are not surprised, as we attribute it all to the intelligence of human beings, the necessities of their organization, and the stress imposed by the changes in the season. Why, then, ought we to be surprised to find that the modern naturalist says that the migratory bird similarly inherits a gradually increasing amount of knowledge from his ancestors, that he has intelligence as well as the human being, and that he has not yet reached the limit of his intellectual development, any more than has the white man? The migrations and the hibernating habits are, therefore, the result of the experience and teachings of many past ages, beginning with the glacial epoch, and producing a habit of life in an intelligent animal, to which he persistently adheres. It is not necessary to suppose that the Creator has given these animals a deeper knowledge of meteorology than has been given to human beings. He who consults the habits of the goose-bone, the ground-hog, the crow, the spider, the wild geese, or the hundred other animals concerning which there are hundreds of rules in books of weather wisdom, is trusting to the intelligence of animals who are less intelligent than himself, and is neglecting to cultivate those faculties and habits of observation and reasoning with which his Creator has endowed him for the very purpose of getting at the mysteries of nature, and utilizing her powers to his own benefit. In other words, the meteorologist would say there is scarcely any truth in the idea that all these mute creatures have, for self-preservation, been fitted with what is to us an unknown sense, informing them of minute changes in the atmosphere, long before the coming of the danger. They have either acquired their habits, as other intelligent creatures do, from experience and reason, or they are wholly guided by natural causes beyond their control.

"What is true of the animals, is still more plainly true of vegetables; so that, in fact, nearly all the rules for weather prediction founded on the behavior of plants, such as the contracting of the down of the dandelion, the closing of the pink-eyed pimpernel or convolvulus in the day-time, or the gathering of dew on stones, or the falling of soot in the chimney, are all simply so many hygroscopic phenomena: and a well-made hygrometer, as used by meteorologists, will give more accurate indications than any of these natural objects.

"Another erroneous idea, very widely prevalent, is shown by the tendency to explain this or that phenomenon as being due to atmospheric electricity, or possibly to ozone. Both of these subjects have thus far eluded the attempt to observe them satisfactorily. We have, indeed, so-called records of electricity and ozone; but it is safe to say that with very few, if any, exceptions, we have thus far been unable to interpret these records, and demonstrate that we have been really observing a purely atmospheric phenomenon: hence I rate as a popular error the frequent quotation of these as an active cause of meteorological phenomena.

"We have many of us been accustomed to speak of the delightful influence of a summer thunder-storm in clearing and cooling the air, and it is true that cool, clear air does frequently follow these storms. We are, however, here in danger of confusing cause and effect. A certain class of thunder-storms is not generally followed by cooler air,— that is to say, any cooler than it would have been without the storm; while another large class is followed by a decided fall in temperature. In these latter cases, if I am not mistaken, the underflow of cooler air contributes so largely to the existence of the storm, that at first sight one would say that the refreshing cooling of the air is the cause, and not the effect. But a truer philosophy would show that uprising, warm, moist air has caused both the inrush of cool air and the thunder-storm, so that the two latter do not stand to each other at all in the relation of cause and effect.

"Again: among my questions is this: —

"'What is the special cause of the regular equinoctial storm?'

"I am sorry to say that I know no 'regular equinoctial.' An old writer says: 'Ye wind hath been noticed to be very tempestuous at ye time of ye equinoxes.' All over the world it is a favorite habit among mankind to find a name or a proverb to suit every striking weather item: thus, we have a Sunday rain, a Michaelmas thaw, an equinox storm, a dog-day heat, etc. These names, however, are only names, and prove nothing as to the reasons underlying the phenomena. With the changes of the sun's position, and the consequent distribution of hot and cold air, there come alike to Old England and New England, months of stormy weather. The storm that appears next before or after the 21st of March or the 21st of September is dubbed the equinoctial of that year. The frequency of storms is about the same for several successive weeks, and one is as likely to occur on any other date as the date of the equinox."

A WISE WASP.

While sitting one summer day at the side of the house, on a platform which served as a piazza, but was roofed only by the branches of two large trees, something dropped upon my head, and rolled into my lap, when I saw a large white-bodied spider in the clutches of a small wasp. Hastily brushing these unceremonious visitors upon the floor, I watched to see if the wasp would succeed in flying away with his huge enemy. After a struggle the spider lay quiet; and the wasp ran around, seizing first one part, then another, but finally went away, as I supposed, for help. In about a quarter of an hour he returned, still alone, and began trying again, as I thought, to find some place by which he could seize the round body, and carry it away. Again he departed without his spider. This time I watched him, and saw him disappear at the edge of the lawn, under a pear-tree, and, following, found him, after some searching, diligently at work, with another wasp, in enlarging a hole in the ground, having already thrown out quite a little mound of earth. I was surprised, for I did not then know that any kind of wasp lived in the ground.

I returned to the piazza; and soon, when the wasp came back, I was convinced, by more careful watching, that he was measuring each part of the spider's body, instead of trying to get hold of it. The antennæ seemed to be the organs mostly employed in this operation. When he went home again, I was before him, and saw him meet his co-worker, put his head close to his, and evidently inform him that the doorway was not yet big enough, for they fell busily at work enlarging it. Then more measuring, more digging; until, after three long hours, he returned, this time with his friend, and they carried away their prey, and bestowed it in their underground home. — *The Owl.*

THE STRENGTH OF SNAILS.

Perceiving a common snail, *Helix aspersa*, crawling up the window-blind one evening, it occurred to me to try what it could draw up perpendicularly. Accordingly I attached to its shell four reels of cotton, fastening one after the other, until I ascertained that a greater load would exceed the limit of its strength. I then weighed the entire load, and found that it weighed two ounces and a quarter, while the snail weighed only a quarter of an ounce. Thus, it was able to lift perpendicularly nine times its weight. I then made an experiment with a larger snail, weighing one-third of an ounce; the load being composed chiefly of the same material as the last, but so placed as to be drawn in a horizontal position on the table. Reels of cotton to the number of twelve were fastened to it, with a pair of scissors, a screw-driver, a key, and a knife, weighing altogether seventeen ounces, or fifty times the weight of the snail. The same snail, when placed on the ceiling, was able to travel with a weight of four ounces suspended from its shell. I next tried it on a piece of common thread, suspended and hanging loose, with another snail of its own weight, which it carried up the thread with apparent ease. After this I tried it on a single horse-hair, strained in a horizontal position; but it had then enough to do to crawl over this narrow bridge without a load. — E. Sandford *in Zoölogist.*

SCIENTIFIC BREVITIES.

The Rotundity of the Earth. — In a recent paper to the Helvetic Society of National Science, Professor Dufour of Morges calls attention to the deformation of images on large sheets of still water through the roundness of the earth. Instead of appearing equal to the object, the image is sometimes so compressed in the vertical direction as to be almost unrecognizable. Such is the case with the church-tower of Montreux (on the Lake of Geneva) as seen from Morges. One may see the same thing in images of distant ships and their sails, the eye being near the water-surface. After looking for a moment (M. Dufour says), one perceives the roundness of the earth as distinctly as that of a ball held in the hand.

Number of Hairs in the Head. — According to the *British and Colonial Druggist*, a German man of science has taken four heads of hair of equal weight, and then proceeded to count the individual hairs. One was of the red variety, and it was found to contain 90,000 hairs. Next comes the black, with 103,000 hairs to its credit. The brown had 109,000, and the blond 140,000.

A Perfect Pendulum. — An English physicist has, it is said, made a perfect pendulum by suspending a lead shot by a single fibre of cocoon silk in a vacuum produced by a Sprengel pump. The shot, one-sixteenth of an inch in diameter, weighs one-third of a gram, is suspended by a two-foot fibre, and is placed in a tube three-quarters of an inch internal diameter. It has a vibrational range of a quarter of an inch on each side of midposition, the vacuum being equivalent to one-tenth of a millionth of an atmosphere.

Chemical Students. — How the study of chemistry has increased of late may be judged from the fact, that, while in 1866 the Berlin laboratory was visited by sixty-three students, it now counts one hundred and two, and the number of students attending Professor Hofmann's lectures on chemistry has increased from seventy-nine to three hundred!

The Valley of the Nile. — It is stated that the specimens of clay from the Royal Society's borings in the Nile delta have not at present yielded any but "derived" fossils; but beds of gravel found at a depth of a hundred and twenty feet show that the whole surface was formerly a hundred and twenty feet higher, and was that of an ordinary river-valley.

Peculiar Crystals. — We were recently shown a group of crystals of bromide of potassium which had not only the usual cubic form, but also comprised perfect octahedrons and the intermediate modifications of the cube, as well as cubes with hemihedral modifications. These variations from the common form are quite unusual in salts of this class.

A Remarkable Mirage. — A correspondent writes from Venice to the *Frankfurter Zeitung*, that one or two days before Christmas a singular phenomenon was seen at Savile, near Udine, which recalls accounts of the mirage sometimes presented near Messina. The sky was partially covered by clouds, in which the surface of a calm sea was discerned, with boats passing over it, and even a steamer cutting its way. Presently houses came in to view, then large, beautiful buildings, palaces, and churches; and, as the features became more defined, the Cathedral of St. Mark, with the Piazza and Tower, and the neighboring canals, were plainly presented. The spectacle faded gradually away, having made a great impression on all who saw it.

Professor Tyndall says the sky is indebted for its blue color to the particles floating in the air.

The Leyden Jar was discovered in 1745, by Cuneus, a philosopher of Leyden.

Practical Chemistry and the Arts.

ARTIFICIAL ICE-MAKING.

Of late years the use of machines for making ice has greatly increased; and although the methods and apparatus of different manufacturers differ widely, yet the principle is in all cases the same, and a brief explanation of their action may be of interest.

When a liquid is changed into vapor, a large amount of heat is absorbed, — or becomes latent, as the term formerly was. In the case of water this only occurs at a high temperature (212°); but there are certain substances which are gaseous at ordinary temperatures, and can only be reduced to liquids by cold or pressure. Among these are sulphurous acid (SO_2) and ammonia (NH_3). Now, if these gases are condensed to liquids, and allowed to resume the gaseous state, a large amount of heat is absorbed, or, in other words, cold is produced which is sufficient to quickly freeze water placed in contact with the vessels or pipes containing them.

The general action, then, of an ice-machine, is as follows: The gas, usually one of the two mentioned above, is compressed to the liquid form in a coil of pipe, by means of a powerful steam-pump. In this process just as much heat is given out as will be absorbed later on, when it changes back into gas; and, to prevent the coil from becoming hot, it is cooled by a stream of water flowing over the outside. The liquefied ammonia or sulphurous acid then passes into another set of pipes, where the pressure is removed, and flies back into gas again; in so doing, producing intense cold. Usually these pipes are placed in a tank filled with strong brine or some uncongealable liquid, in which is placed square cans filled with water, which in a few hours is frozen into a solid cake of ice. The gases are then pumped back into the first coil, and recondensed, so that the process is a continuous one.

It will be seen from this description that artificial ice is not contaminated in any way with chemicals, but is as pure as the water from which it is made. The expense is small, and ice can be made in hot climates in this way, and sold at a less cost than that transported from Northern lakes or rivers, where nature furnishes the freezing facilities free of cost. This same principle is equally well adapted to the cooling of air, and rooms are fitted up with coils of pipe by which any desired temperature can be continuously kept up, either just above the freezing-point, or many degrees below it. Ocean steamers are now supplied with this apparatus, and the temperature of the hold is kept so low that fresh meat and provisions can be transported for the longest voyages without injury. These machines are constantly coming into more extensive use, and already play a very important part in industrial and manufacturing operations.

It is reported that a depth of over fifty-two hundred feet has been reached in boring at Schladerbach, near Halle.

A PORTABLE SIGNALLING APPARATUS.

This apparatus, invented by Dr. Gavoy of France, is designed for communicating at a distance, with special reference to military use. It has received the approval of the French Minister of War, and may be adopted for the army.

The general appearance of the instrument is shown in Fig. 1, while the diagram (Fig. 2)

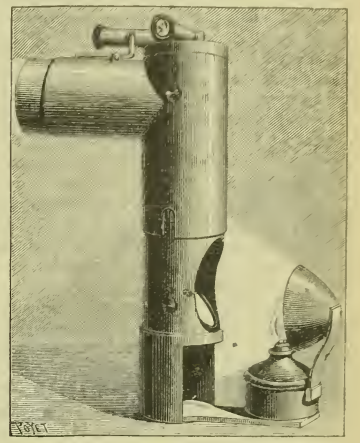


Fig. 1.

shows its internal construction. The measurements are given in centimeters, equal to two-fifths of an inch. The plane mirror, *A*, reflects the rays of sunlight to a second mirror, *B;* from thence they pass through a plano-convex lens, *D*, which converges them to a focus at the diaphragm, *F*. Thence the rays pass through the double convex lens *D′*, which renders them parallel, so that they can be transmitted through any distance without loss of intensity. A small shutter, *O*, which can be moved at will from the outside of the tube, furnishes the means of extinguishing the beam of light for any desired length of time. A small telescope, *C*, bent at a right angle, for convenience in observing, is placed outside in the axis of the beam of light; so that, when the person or place with which it is desired to communicate can be seen through it, then the beam of light is directed exactly upon the spot.

Fig. 2.

For signalling at night, the light of a lamp is used; but as the rays of light from this source are divergent, instead of being nearly

parallel, as in the case of sunlight, the reverse side of the mirror *A* is made slightly concave, so that the rays reflected to *B* are rendered parallel.

The method of operation is as follows: The light of the sun or lamp being reflected from the mirror, the apparatus is held in the hand; and the operator, looking through the telescope, brings into the field of view the station with which he wishes to communicate. A small opening (not shown) in the centre of the mirror *B* allows a spark of light to pass into the telescope, so that the operator can ascertain at the same time that the light is properly reflected through the instrument. It is then only necessary, by working the shutter, *O*, to send flashes of light of greater or less length, corresponding to the Morse telegraphic alphabet, — a short flash representing a dot, and a long one a dash, — by which means any message can be rapidly sent or received. At night, of course, the range of the receiving station must be indicated to the sender by a bonfire or bright light.

The portability and cheapness of this instrument, as compared with the cumbersome signalling apparatus formerly in use, is very marked. Unlike the American system of signal-flags, it can be used by night as well as day, and the message is only visible to the person with whom it is intended to communicate. It has been operated successfully in Paris for distances of over a mile, but is doubtless capable of a much greater range, limited only by the distance at which the light ceases to be visible.

A MAGIC COMPASS.

This ingenious instrument has been devised by a French watchmaker, M. Dentan, and, although of not much practical use, can furnish

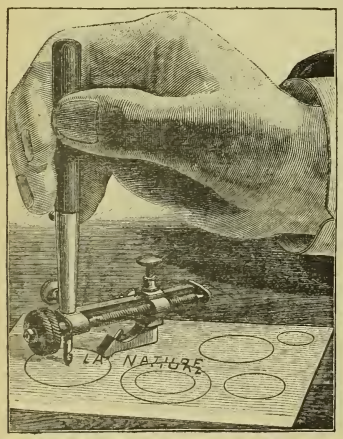


Fig. 1.

considerable amusement and mystification by the results obtained with it. The principle is that of an ordinary drawing-compass, except that one of the points is replaced by a very sharp and minute steel blade, which is set obliquely to the upright handle of the instrument, and can be adjusted to cut any thickness desired. By applying it to a piece of cardboard, and revolving it, a cut will be made half through the card; then, by reversing the

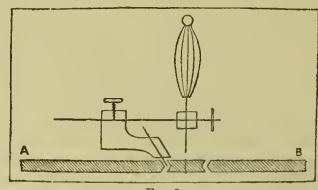


Fig. 2.

card, and repeating the operation, a circular piece will be cut out, which, although perfectly free to revolve, is securely dovetailed into the body of the card. The process will be better understood by examining Fig. 2, which shows the compass and card in section.

Fig. 3 shows a business-card with some peculiar transformations effected by the compass. Several concentric circles can be cut, as shown in Fig. 1, and even more surprising results obtained. The compass can be used successfully upon cards of a twenty-fifth of an inch or

Fig. 3.

more in thickness, and it is a pity that such an ingenious device cannot be made to serve some useful purpose.

The engravings illustrating this and the preceding article are reproduced from *La Nature*.

COTTON-SEED OIL IN OLIVE OIL.

The *Drogisten Zeitung* quotes a statement to the effect that olive oil is frequently adulterated with cotton-seed oil, the refining of which has made such progress of late years that it is produced quite clear in color, and thus there is no longer a reddish tint to indicate its presence, which can only be proved by chemical analysis. The extent of the admixture sometimes reaches and even exceeds seventy-five per cent. One mode of readily testing for this adulteration is with nitric protoxide of mercury, the yellow simple basic salt of this chemical combination being employed ($2Hg_2O$, NO_5H O). About one-seventh to one-sixth of an ounce of this is dissolved in a cylindrical test-glass in about one-sixth to one-fifth of an ounce of nitric acid. On this solution the oil to be tested is poured in such quantity that the test-glass is about two-thirds full. The two fluids are then shaken together for five or six seconds, and the change in color is at once noticed. Cotton-seed oil, when treated in this solution, becomes dark brown or almost black; but, after a short time, the solution becomes colorless and clear. Pure olive oil has a greenish or light-yellow tinge, while the solution under the layer of oil assumes a dark-red or brown color. Olive oil mixed with fifty per cent cotton-seed oil assumes in this process a brick-red to a brownish-red tinge. A mixture of twenty-five per cent makes orange yellow to red yellow. The solution of the mercurial preparations remains for the most part colorless with mixed olive oils, as well as pure cotton-seed oils. Pure olive oil should never assume a reddish tinge in this test. The redder or browner it is, the more cotton-seed oil does it contain. Thus, a little practice allows of a color-scale being formed, by which the presence even of five per cent of cotton oil may be discovered in a few seconds.

PRACTICAL RECIPES.

Tempering Springs. — The following method is recommended for large springs: Make a bath of six gallons lard or fish-oil, a pound and a quarter gum-arabic, and a quarter of a pound rock salt. Mix well, and it is ready for use. Heat the steel to a dark cherry red; cool, and do not draw the temper.

Expanding Cement to stop Leaks in Mines. — Calcined soda, anhydrous alum, kieserite or oxychloride of magnesium, mixed into a paste by the process of M. Tietjens, will swell as it hardens, and is used by him to inject, by a suitably arranged pipe, into rock-fissures, to stop flow of water.

Blackboard Paint.

Shellac	4 ounces.
Ivory black	2 "
Emery (in fine powder)	1 ounce.
Ultramarine blue	1 "
Methylated spirit	1 quart.

Mix the whole, and agitate occasionally, until the shellac is dissolved.

Alloy which expands on Cooling. — Most metals and alloys shrink or contract on cooling; but an alloy which will expand on cooling may be made of lead, nine parts; antimony, two parts; bismuth, one part. This can be advantageously used to fill small holes and defects in iron castings.

Non-conducting Coating for Pipes. — A very efficient and cheap non-conductor for steam-pipes can be made from four parts of sifted coal-ashes, one part plaster Paris, and one part flour. These should be mixed up with water to the consistency of thick mortar, and laid around the pipe enclosed in a trough. After it has been thoroughly dried out by the steam passing through the pipe, it may be wrapped with muslin, to prevent its cracking or breaking off. By mixing plasterers' hair with it, it may be made self-sustaining.

Soldering Flux. — Chloride of zinc, so much used in soldering iron, has the drawback of being unwholesome when used for soldering the iron tins employed to can fruit, vegetables, and other foods. A soldering mixture has been found which is free from these defects. It is made by mixing one pound of lactic acid with one pound of glycerine and eight pounds of water.

Positive Copies of Drawings. — Coat suitable paper with a two per cent solution of bichromate of ammonia, to which a little grape-sugar has been added, and dry in the dark. The paper containing the drawing is laid upon it, and exposed to light until the prepared paper has assumed a gray color; now dip into a one per cent solution of nitrate of silver, one-tenth the volume of which consists of acetic acid. The positive image developed thereby consists of bichromate of silver, which becomes dark brown on drying. — *Phot. News.*

Home, Farm, and Garden.

THE MYSTERIES OF PLANT-GROWTH.

III.

I have already observed that the state of our knowledge of every thing connected with the workings of the inner organisms of plants is extremely small; so small, indeed, as to be almost insignificant. We note certain effects, and endeavor to divine their causes; but, although we may succeed in constructing what appear to us to be rational theories, we are, in all probability, very far from grasping the true nature of many important phenomena.

The ways of the Omuipotent are not our ways; and there are certain processes which are presumably hidden, for some wise purpose, from our understandings. Thus, for example, in the two great divisions of chemistry, while we have made enormous progress in the inorganic, our success in the organic branch leaves much to be desired.

What, in fact, can we say with certainty of organic bodies, beyond that they are all combustible, and that, when submitted to calcination, they are either transformed into ashes, consisting of incombustible mineral matter, or entirely disappear. The small quantity of ashes alone remaining perceptible to the senses of sight and touch, we conclude that plants and trees are mere combinations of various aerial bodies so associated and welded together as to produce, from the intangible and unseen, the delightful and variegated vegetation that surrounds us. It may be argued, that modern progress has furnished us with means of measuring and weighing gases in a sufficiently accurate manner to determine in what proportion they are present in any given compound. But in what, may I ask, does this ultimate analysis practically result? We affirm, for instance, that cane-sugar is composed of $C_6H_{12}O_6$; but is there any likelihood of our ever being able, with all our intelligence and knowledge, with all our science and its appliances, to so put similar proportions of these elements together as to form sugar artificially?

Again, and this time a more startling example: we have pronounced the composition of *quinine* to be $C_{20}H_{24}N_2O_2$, and that of *strychnine* to be $C_{21}H_{22}N_2O_2$; in other words, the proportions of their *ultimate constituents* are virtually identical. How is it we are unable to explain why the first should be the most valuable and harmless of our medicines, whereas the second is the deadliest poison in our pharmacopeia?

May we not assume that there are still some elements to discover, some agencies in nature, that have as yet escaped detection?

I advance these extenuating arguments to show why my investigations into the part played by hydrogen in plant economy have had such poor results, and why so many chemists have recoiled before the difficulties by which a satisfactory solution of this vast enigma is made impossible.

The carbo-hydrates elaborated by plants — glucose, cellulose, starch, dextrine — are, then, represented by charcoal, — and by hydrogen and oxygen in the proportions in which the two latter combine to form water; but their other principles — fats, essences, resins, etc. — are mainly composed of hydrogen and carbon only, the small quantity of oxygen they sometimes contain being insufficient to form water with the hydrogen discovered by analysis.

Various theories have been suggested by different authorities to account for the formation of these fats and resins; but it would serve no useful purpose to reproduce them, and I shall confine myself to the examination of the two questions which appear to me most worthy of studious consideration.

First, Do vegetables decompose water as they do carbonic acid? and do the hydrogen and charcoal directly unite in a nascent state to form carbo-hydrates?

Second, As a consequence of the reactions described in the latter part of my last paper, do vegetables form carbo-hydrates only? and do the fats, essences, etc., result from a subsequent process of reduction?

The renowned De Saussure, writing, at the commencement of the present century, upon the decomposition of water by plants, says, that when vegetables appropriate its oxygen and hydrogen, they cause it to solidify, but that this quasi-assimilation is only properly defined when it is associated with carbon.

The water thus solidified can only, in his opinion, part with its oxygen after the death of a plant or some of its members; for vegetables never directly decompose water for the mere purpose of assimilating its hydrogen. The oxygen they evolve is due to no other cause than their internal decomposition of carbonic-acid gas.

Continuing his argument in his own words, "Thin-leaved plants vegetating in a watery solution of nitrogen and oxygen gases, and exposed to the varying influences of sunlight and darkness, betray no signs of decomposing the water, and cause no increase in the known quantity of oxygen; I cannot, therefore, attribute the oxygen they set free, if entirely submerged, or if transferred to an atmosphere of pure nitrogen, to their decomposition of water, since it is a well-known fact, that in the absence of oxygen, their whole substance contributes to the generation of carbonic-acid gas.

"If certain resinous or oily plants are caused to vegetate in common air, deprived of its carbonic acid, they will evolve large quantities of oxygen gas; but this oxygen, although it may, perhaps, have been originally combined as water, is only really produced by the carbonic-acid gas arising from a decomposition of their own substance under the action of solar heat.

"I have demonstrated this by placing such plants in proximity to some body with an affinity and capacity for absorbing carbonic-acid gas, and have found them to add no more oxygen to their surroundings by night or by day, and, while continuing to grow vigorously, to give no further indication of water decomposition."

More recent experimenters look upon these views with any thing but favor, Boussingault especially being in opposition to them.

He made a careful series of analyses of vegetables grown in burnt sand, the results of which I annex, and which prove that they contained a quantity of hydrogen considerably in excess of what was required for the formation of water with the existing oxygen: —

	Assimilated Oxygen.	Assimilated Hydrogen.	Water forming Hydrogen.	Excess of Hydrogen.
Clover,	1.226	0.176	0.153	0.023
Peas,	1.223	0.215	0.155	0.060
Wheat,	0.608	0.078	0.076	0.002
Oats,	0.804	0.087	0.100	0.013

When we consider that all these plants had been developed entirely apart from organic substances, it seems rational to infer from these experiments that the water they had absorbed must have been dissociated.

In my own opinion, the facts I have already related concerning the decomposition of carbonic-acid gas under the influence of sunlight, argue altogether in favor of the Boussingault theory; for I have frequently found the quantity of oxygen then evolved to be considerably greater than the carbonic acid absorbed, and how can this be explained if not by the phenomenon of water decomposition?

Coming now to the second hypothesis, is it possible that the hydrogen-containing elements result from a subsequent reduction of the carbo-hydrates?

Those who have studied this question, admit that there is a very close relationship between the substance called mannite, and the glucoside isomerics formed by the combination of grape-sugar with various neutral organic bodies.

Mannite is found in variable quantities in a great variety of plants, and is the result of fermentation, especially of the viscous fermentation of sugar; its chemical composition is represented by the formula $C_6H_{14}O_6$, while that of glucose or grape-sugar is $C_6H_{12}O_6$.

It has been ascertained that the olive-tree contains, at the commencement of vegetation, large quantites of mannite, but that, upon the complete development of the fruit, no trace of this mannite remains. *Its place has been taken by a fatty body!* May we not, therefore, look upon it as the origin to which the olive owes its oil?

Formiates, as we all know, will generate hydrocarbons when submitted to the influence of an elevated temperature; and there is really no reason why we should infer that the fats, resins, and essences in plants are produced by a direct combination of hydrogen and carbon, rather than by a series of secondary reactions exercised within the plant upon the oxygenated compounds, and resulting from the combination of carbonic oxide either with the hydrogen or with the water.

The forces engaged in the phenomena of vegetation are undeniably of the most energetic kind, capable of effecting, with the greatest ease, combinations which in the laboratory are extremely difficult when not impossible. Need I do more, in support of this assertion, then point to the complicated process and excessive heat required for the decomposition of carbonic-acid gas?

Francis Wyatt, Ph.D.

New-York City, *April*, 1887.

ORIGIN OF CATTLE.

Professor Boyd Dawkins, as the result of his investigations as to the origin of British breeds of cattle, believes the two principal stocks from which all the breeds are descended are undoubtedly (1) the *Urus*, an animal wild in the forests of Europe later than the days of Charles the Great, and which is believed to have been extinct in the British isles; and (2), the *Bos longifrons*, or "small Celtic Shorthorn," an animal which never was aboriginally wild in Europe. Both were probably domesticated in Asia, and both made their appearance together in the neolithic age, in the possession of those who lived on the wooden platforms and artificial islands in the Swiss lakes. The remains of the latter are, he says, to be found all over Europe, in refuse heaps belonging to various periods, from the neolithic age down to well within the historical period. It is the only domestic ox which he has met with in the large number of refuse heaps in the British isles, ranging from the neolithic age down to the time of the English invasion, and is represented by the present Highland cattle, the small Welsh and small Irish cattle.

The first, or the *Urus* stock, preserved in Great Britain almost in its aboriginal purity in the so-called wild cattle of Chillingham, he has been unable to trace farther back than the invasion of Britain by the English, and of Ireland by the Scandinavians. As the evidence stands, it was unknown in these islands as a domesticated animal before this time.

The present breeds are, in the opinion of Professor Dawkins, descended from the two stocks, and are the result of crossing and selection. The polled cattle are considered to be the result of selection,

in which advantage has been taken of a tendency to revert to an ancestral, hornless type, probably as far back as the miocene age. He would expect to meet with them from time to time in every breed, just as from time to time a horse is born with three toes, which have been derived from his remote miocene ancestor, the *Anchiterium*. On this point it is interesting to note the polled skull of the *Bos etruscus* in the Florence Museum, belonging to a fossil species, usually horned, living along with extinct elephants and rhinoceroses and other animals in the plains of Lombardy, in the Val d'Arno. Lord Selkirk's letter to Professor Dawkins shows how the horns were bred out of the Galloways, and his version is confirmed by the independent evidence collected by Youatt. The Galloway, however, he says, were not the only polled cattle in Britain, although they were the ancestors of the Norfolk and Suffolk breeds. The Gisburne cattle, now extinct, but of which there is a speciman in the museum at Owens College, were polled, being in other respects identical with the Chillingham. It is, however, smaller. The Gisburne polled cattle became extinct in 1859, and the skull of the last bull is in the museum, as stated. — *Exchange*.

OLEOMARGARINE UNDER THE NEW LAW.

The following is a report of eight tests of butter made by the United States Internal Revenue Collector at Des Moines, Io. : —

1. Butterine ; pronounced good butter.
2. Creamery butter, two years old ; pronounced oleomargarine.
3. Fresh creamery butter, three ounces of salt to the pound ; pronounced good butter.
4. Sample, one-third lard ; pronouuced good butter.
5. Creamery, five ounces of salt to the pouud ; pronounced good butter.
6. Creamery, churned at 73° temperature ; pronounced oleomargarine.
7. Sample, half lard ; pronounced good butter.
8. Unsalted creamery from the churn ; pronounced oleomargarine.

It will be observed that the inspector hit it right two times out of eight. — *Manufacturer and Builder*.

SELECTED RECIPES.

Mayonnaise for Lettuce. — Take the yolk of one egg, boiled very hard; let it get cold, and mash it until free from lumps; then add to it, and mix well the yolks of two raw eggs; add oil until thick and light ; work well. The working is the great thing, and, when commenced, must not be left. Afterwards add two tablespoonfuls of vinegar, and salt and mustard to your taste.

Old Dominion Chicken-Pie. — Take one or two chickens, according to the size of the pie you wish; have them prepared early in the morning, cut in pieces, and laid in salt aud water until time for cooking; then put them in a saucepan with one quart of water, and let them stew until tender. While it is boiling, mix two tablespoonfuls of flour smoothly with a little water, and stir into the liquor until it thickens. Season with pepper, salt, and celery seed; and, when it is done, add sufficient butter to make a rich gravy. Set aside upon the stove, to keep hot, while you prepare the paste Make it rich, and bake the bottom crust first, as this makes it crisp, and prevents it from absorbing the gravy; then put in the chicken, add gravy and the top crust, and bake all together.

Potato Puffs. — Take two cupfuls cold mashed potatoes, stir into them two tablespoonfuls of melted butter, and beat to a white cream before adding any thing else ; then add two eggs beaten very light, a teacupful of cream or milk, and salt to taste. Beat all together in a deep dish, and bake in a quick oven until nicely browned.

Ham Toast. — A quarter of a pound of lean ham, chopped very fine; the yolks of three eggs, well beaten; half an ounce of butter; two tablespoonfuls of cream; and a little red pepper. Stir it over the fire until it thickens, then spread it on hot toast. Garnish with parsley.

Rice Batter-Cakes. — Boil one pint of rice very soft ; mix in, while hot, a tablespoonful of butter or lard, and let it cool. Beat into it a teacupful or more of milk, a teaspoonful of salt, two well-beaten eggs, and enough sifted flour to make a soft batter.

Sauce for a Fish. — Two tablespoonfuls of unmade mustard, a little cold water to mix it, the yolks of three raw eggs, and the whites beaten to a froth and stirred in. Put in a stew-pan, and cook until it thickens.

A Nice Way for using the Remains of Cold Meat. — Chop the meat very fine with some ham or other bacon; add a little salt, cayenne pepper, nutmeg, parsley, a small onion chopped fine, a few bread-crumbs, and two well-beaten eggs, to a pound of meat. Put in a saucepan with two tablespoonfuls of cream and two ounces of butter. Stir over the fire for five minutes. Let the mixture get cold, and put it into a light paste iu the form of patties.

Almond Rout-Cakes. — Mix one pound of ground almonds with the same weight of finely pulverized sugar; intensify the flavor with a little essence of lemon; form this into a smooth paste with yolk of egg. Make into any fancy shapes according to taste, and decorate with dried cherry, preserved gage, apricot, etc. Lay each set of patterns on square pieces of cartridge-paper dusted with sugar, let them remain until next day, then bake in a moderate oven.

Almond Walnuts. — "Almond walnuts" sounds rather paradoxical, but never mind. Have rout-cake paste as above, mould the kernels in a walnut mould, and place them on cartridge-paper; next mould the half-shells, and place them on paper also; next day bake them off, the shells a good brown tinge, while the kernels can be dried quite pale; join the half-kernels to the half-shells with icing, and it will make a good representation of a walnut half open.

The above recipes, with the exception of the two last, are given by Adelaide Preston in *Good Housekeeping*.

HOUSEHOLD HINTS.

Old Chamois-Skins may be softened and cleaned by the following process: Rub plenty of castile soap into the skin, and soak for two hours in a weak solution of sal-soda in warm water, then rub it well until quite clean. Afterwards rinse in a weak solution of sal-soda and soap in water; after rinsing, wring it dry in a coarse towel; and when fully dry, beat it until soft and smooth, and it will be finer and better than most new chamois-skins. — *American Pharmacist*.

Preserving Flowers. — Mix a little carbonate of soda with the water in which flowers are immersed, and it is said to preserve them for a fortnight. Common saltpetre is also a very good preservative for flowers.

To Cure Creaking Boots. — Well saturate the soles before the fire with boiled linseed oil, after which place the boot-soles to the gentle heat of the fire for some hours, that the oil may thoroughly penetrate through the leather.

Soot for Roses. — Never give up a decaying rose-bush till you have tried watering it two or three times a week with soot-tea. Make the concoction with boiling water, from soot taken from the chimney or stove in which wood is burned. When cold, water the bush with it. Rose-bushes treated in this way will often send out thriving shoots.

The Best Way to keep Mucilage, writes a correspondent, is to preserve it in a bottle corked with an india-rubber stopper. The india-rubber will not stick to the glass, as an ordinary cork does; it fits tightly, preventing access of air from decomposing the gum, and can readily be cleansed. Once used, an india-rubber cork will always be used in the mucilage-bottle.

Hanging Pictures. — Pictures are often hung from two hooks instead of one, to bring the lines of the cord into harmony with those of the walls of the room. It is very difficult to adjust both cords to the same length, but much time and temper can be saved by using a single piece of cord, and passing it behind the picture through both screw-eyes. The proper adjustment can then easily be made by moving the picture to one side or the other.

GLEANINGS.

Nutritive Value of Mushrooms. — The prevalent idea (at least in Europe) that mushrooms are a food of no mean value, is not supported by facts. C. Th. Moerner (*Schweitz. Wochenschr.*) has investigated the subject, and finds that only forty-one per cent of the total amount of nitrogen may be considered as assimilable, and the nitrogen does not amount to more than about six per cent of the dried mushrooms. He calculates, from the above data, that ten and a half avoirdupois ounces of *Agaricus campestris* are equal in nutritive value to only one average-sized hen's-egg; of *Polyporus ovinus*, we need no less than four pounds; nine pounds *Agaricus campestris* are equal to only one pound beef; while of *Polyporus ovinus* it requires sixty-seven pounds.

Hotbeds. — In March and April most gardeners get ready to place all their hotbed glass on cucumbers, sowing the seeds about three weeks before the glass will be ready for transplanting them; one hill of two or three plants being used for each sash. At this season of the year a mild heap of manure works well, made by digging out a trench, fourteen inches wide and fourteen inches deep, along the middle of the bed, and filling it with good fresh horse-dung covered with three inches of loam, in which the cucumber-plants are transplanted.

Horses ought invariably to be *watered* before feeding, or the small particles of undigested food get washed into the intestiues, causing indigestion, stoppage, and colic.

Harness Varnish or "Reviver." — Dissolve, in about half a pint of methylated spirit, two ounces of shellac, half an ounce of Venice turpeutine, and one ounce of gum benzoin. Stir in a sufficiency of a mixture of four parts drop-black, and one of indigo blue, to form a deeply-colored varnish, then make up with spirit to the measure of one pint. Apply with a sponge or soft brush.

Manure. — The manure-heap is the most important of all. A good farmer can be selected by the manner in which he keeps his manure. The manure is the wealth, — the bank on which the check is drawn ; and it is imprudent to neglect it. Drenching rains and scorching suns carry upward and downward the soluble and volatile constituents of the unprotected heap; and often great ditches are dug, to allow the black liquid riches to pass off and away forever. But the good farmer works differently. He makes his manure fine, attends personally to the process of decomposition, protects it from the weather, and endeavors to make it a ready food for the crops when hauled to the fields. Farming pays well — to good farmers.

The Popular Science News.

BOSTON, MAY 1, 1887.

JAMES R. NICHOLS, M.D.
WILLIAM J. ROLFE, A.M.
AUSTIN P. NICHOLS, S.B. } . . . . . *Editors.*

The article by Professor Shaler in this issue of the *Science News* is of unusual interest. In every locality the surface of the earth can be made a most interesting and profitable subject of study; and, as is pointed out, an extended knowledge of geology is by no means necessary to enable one to observe the indications or results of the action of various geological forces in the past or present.

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The complimentary banquet tendered to Mr. Theodore Metcalf of this city, to celebrate his completion of fifty years in the drug business, was a fitting compliment to a gentleman who, since he first opened an apothecary-store in 1837, has always stood at the head of the profession. The gathering included many prominent druggists, physicians, and businessmen of the city, and was an exceedingly pleasant and successful occasion. We trust that for many years to come the firm of T. Metcalf & Co. will remain undissolved.

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Some too confiding investors in this city have had occasion to mourn the sudden departure for Canada of a talented swindler, who professed to have discovered a process by which a substance called "sugarine" could be made out of stareh. The new substance was said to consist principally of pure sugar, and the inventor had the assurance to claim that it could be sold at a price which was really lower than that of the stareh from which he claimed it was made. Five minutes' conversation with a chemist would have shown to the stockholders in the enterprise the impossibility of the scheme; but it apparently did not occur to them to take this precaution, and the outcome was as stated above. While, theoretically, it is not impossible that a method may sometime be discovered of changing starch into cane-sugar, it is certain that the process must be too expensive to compete in any measure with that produced by the beet-root or sugar-cane.

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The investigations of Professor Crookes upon the supposed element yttrium, although not completed, have already given some very remarkable results. Apparently, yttrium is a compound body of some half-dozen or more different substances whose chemical properties are so near alike that they can only be separated by a tedious and complicated process of "fractional precipitation." The spectrum of all these bodies, when volatilized by an electric spark, is identical with that of yttrium; but, when submitted in a vacuum to the action of an electric current, the spectrum of the phosphorescent glow which they exhibit is markedly different in every case. Professor Crookes offers two explanations of these phenomena, — one, that these different components of yttrium are actually different elements; the other, that yttrium is a complete element in itself, but that its molecule is made up of several atoms, and, according to the different groupings of these atoms, the structure of the molecule may so differ as to form the bodies under consideration, which show such slight chemical and physical variations. Professor Crookes does not consider, that, with our present knowledge, we can unhesitatingly accept either of these hypotheses, but prefers to wait for the result of future investigations. The facts observed are certainly very remarkable, and we have but little doubt that we are on the verge of important discoveries as to the nature of the elements, which may profoundly modify our theories of chemical philosophy.

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The subject of impure ice has lately been much discussed in medical journals. There is a common impression that water purifies itself in the act of freezing, but this is only partially correct. Freezing is a process of crystallization, and the tendency is always to eliminate impurities from the crystals; but the foreign matters can, and do, remain entangled in the mass among the intercrystalline spaces. It is also probable that such minute objects as bacteriæ or disease-germs, would not be eliminated at all, and, as their vitality is not affected by the freezing temperature, would render the water from the melting ice dangerous to use. There have been undoubted cases of typhoid-fever and other diseases produced from this cause, and it is a safe rule only to use ice formed from water of assured purity. In other words, wholesome ice cannot be made from unwholesome water.

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SOLUTION.

If we place in a glass of water a lump of sugar or a little salt, we find in a short time that it has disappeared, and become disseminated through the liquid. We know that it has not changed its substance in any way, or been destroyed; for, by evaporating the water, we can recover the whole amount of the solid material. What, then, is the nature of the mysterious change which certain liquids produce upon certain solid bodies, apparently liquefying at ordinary temperatures, substances which in the dry state are only fusible at a very high heat?

There are two explanations offered to account for it. One is, that the change is a purely physical one, and that the molecules of the substance dissolved are, in some way, by the action of the solvent, made to move more freely, and become intermingled with the molecules of the solvent. The other is, that there is a chemical combination between the two bodies, which really forms a new substance, although the affinity is so weak that it is readily decomposed by evaporation.

There are many facts which seem to favor the latter theory. Certain salts crystallize from solution with a definite number of molecules of water known as water of crystallization. These are actually combined with the salt in the crystal, but can be driven off by heat without otherwise changing its composition. Sulphuric acid, alcohol, and other substances, when mixed with water, develop heat, and diminish their volume. In these instances there can be but little doubt that a true chemical combination takes place. Crystallized sulphate of copper is of a dark-blue color; but, when the water of crystallization is driven off, it becomes nearly white, resuming its blue color when moistened. Here again the water must be more closely united to the molecules of the salt than is required by a mere physical combination.

Reasoning by analogy from these undoubted cases of the chemical combination of water with other bodies, it seems very probable that the phenomenon of solution in other cases is a chemical one; but, on the other hand, we find that certain other salts — nitrate of ammonia, for instance — absorb heat, or, in other words, produce cold, when dissolved in water. This apparently indicates that their molecules are separated to a greater distance from each other, and that the change is a physical one. The fact that most substances are more soluble in hot water than in cold, is another argument in favor of the physical theory. The question cannot as yet be considered settled, but the weight of evidence seems to favor the chemical explanation of the phenomena.

While the solubility of most bodies increases with the temperature of the solvent, certain salts, like chloride of sodium, or common salt, are equally soluble at all temperatures. Gypsum and some salts of calcium with organic acids are more soluble in cold than in hot water.

Glauber's salt, or sulphate of soda, presents a curious irregularity in its solubility. It crystallizes in two different forms, — one with seven molecules of water of crystallization ($Na_2SO_4 + 7H_2O$), and one with ten molecules ($Na_2SO_4 + 10H_2O$). The former is much more soluble: but at a temperature 91° F., even when the salt is dissolved in water, the less soluble compound is apparently formed; so that, up to 91°, the solubility of the salt rapidly increases, but beyond that point it diminishes with the increase of temperature. The peculiar phenomenon of *super-saturation* is due to this fact. If a saturated solution of sulphate of soda is made at the boiling-point, and allowed to cool out of contact with the air, the whole of the salt remains in solution in the more soluble modification with seven molecules of combined water; but if, after cooling, it is brought in contact with the dust of the air or a crystal of the salt, it is suddenly transformed into the less soluble modification, and the excess at once crystallizes out with considerable evolution of heat, indicating the combination of the three additional molecules of water with the salt. This is an interesting experiment, and can easily be performed by allowing the hot solution to cool in a flask

with a piece of rubber or bladder tied tightly over the mouth, and, after it has cooled, rupturing it with a knife, when the liquid will immediately become filled with crystals. Or, if one has the necessary skill, the hot solution may be hermetically sealed up in a large glass tube, and can be kept indefinitely till the air is admitted by breaking off the end.

One of the objects most earnestly sought for by the old alchemists was the *universal solvent*, which would dissolve all kinds of matter. This, they thought, would prove to be the precious elixir of life; but their search was a futile one, and it has remained so to this day. While there are scarcely any substances which are not soluble in some liquid, yet there is no liquid which will dissolve them all. The nearest approach that has yet been made to a universal solvent is pure water, which dissolves to a very slight extent many substances which were formerly considered insoluble, and is, perhaps, a greater blessing to mankind than the alchemists' fabled elixir vitæ, in the search for which so many of them abridged even the span of life allotted to them by nature.

TUNGSTEN.

TUNGSTEN, so called from the Swedish name of one of its ores, meaning heavy-stone, is a metal belonging to the chromium group of elements, which comprises, in addition, the metals molybdenum and uranium. The trioxides of this group form acids which yield very characteristic salts. Bichromate of potash is a familiar example.

In 1781 Scheele showed that the mineral tungsten, instead of being a tin-ore, as was then supposed, was composed of lime combined with a peculiar acid; and two years later the Spanish chemists Jose and Elhujar found that the same acid was contained in the mineral wolfram, combined with iron and manganese, and succeeded in making metallic tungsten.

Tungsten has the symbol W, from wolfram, and, with the exception of the elements which take their symbol from their Latin names, is the only element whose symbol is not an abbreviation of its name. Its atomic weight is 183.5.

The principal sources of tungsten are the minerals referred to above, and it occurs rather sparingly. The compounds are obtained from the ores by roasting them in a reverberatory furnace with soda-ash and nitrate of soda, and leaching out and crystallizing the soluble sodium tungstate.

The metal has been obtained in the form of a bright-gray powder with a specific gravity of 19.1. This is probably somewhat too low; but, as the metal has never been fused into a solid mass, the actual density remains uncertain. The addition of tungsten to steel is said to improve its quality by increasing the hardness and tenacity, but this application has not been commercially successful.

Tungsten unites with chlorine, bromine, iodine, and other allied elements, forming well-defined salts. It forms two oxides, WO_2 and WO_3. There is also a compound oxide, $2WO_3+WO_2$. The trioxide is the most important, and forms an acid (H_2WO_4) analogous to chromic acid. There are nine sodium salts of this acid known, of which the *paratungstate* $Na_{10}W_{12}O_{41}+28H_2O$ is the only one of any commercial importance. It is prepared, as mentioned above, by roasting the mineral wolfram (calcic tungstate) with soda-ash, and lixiviating the fused mass. This salt is sometimes used, as a substitute for "tin-salts" (sodic stannate), as a mordant in dyeing; but its most important use is in rendering woven fabrics uninflammable.

If cloth is soaked in a twenty per cent solution of tungstate of soda, and allowed to dry, it will not burst into a flame when brought in contact with fire. It will slowly carbonize or smoulder, but the terrible accidents from burning clothing can be entirely prevented by this means. In preparing linen and light muslin garments in this manner, the solution is usually mixed with the starch. The dresses of the ballet-dancers in many European theatres are now prepared in this manner, thus preventing all danger of ignition from the footlights. The addition of about three per cent of phosphate of soda to the tungstate has been recommended as an improvement. Wood can be treated in the same manner; but it is rather an expensive process on a large scale, and, as it does not render the wood entirely incombustible, is not very well adapted for this purpose. The commercial salt, which is sold at about fifty cents per pound, is suitable for applying to clothing.

Tungstic acid has recently been used as a substitute for chromic acid in galvanic batteries. It has the advantage that the tungstic salts which form, redissolve by adding a little phosphoric acid, and tungstic acid which has been reduced by the electrodes is regenerated by the oxygen of the air.

None of the other compounds of tungsten are of any interest, except from a chemical stand-point. Among these the compounds with silicic acid are the most peculiar. One of these has the symbol $4H_2O\ Si\ O_2 12WO_3$, and is known as silicoduodecitungstic acid. This tendency to form compounds with very complex molecules is quite characteristic of tungsten, and some examples of even more complex salts can be found in the *Science News* for January last, p. 5.

Tungsten has the remarkable effect upon steel of increasing its magnetic power. A horseshoe magnet of ordinary steel, weighing two pounds, is considered of good quality when it will support seven times its own weight; but a similar magnet made of steel, containing tungsten, may be made to support a weight twenty times greater than itself.

With the exceptions noted above, tungsten and its compounds have no especial practical value or use in the arts; but in the future it may be found, like vanadium, iridium, and some other metals, to possess some valuable properties not pertaining to any other substance.

METEOROLOGY FOR MARCH, 1887.

TEMPERATURE.

AVERAGE THERMOMETER.		Lowest.	Highest.	Range.
At 7 A.M.	24.97°	9°	43°	34°
At 2 P.M.	35.87°	25°	49°	24°
At 9 P.M.	28.13°	17°	36°	19°
Whole month	29.66°	9°	49°	40°
Second average	29.27°	9°	49°	40°
Last seventeen Marches	32.29°	24.45°, in 1872.	39.18°, in 1878.	14.73°
Second average	31.91°	24.02°	38.84°	14.82°

The lowest point reached the past month was 9°, on the morning of the 5th; the highest 49°, on the 21st. The coldest day averaged 17⅓°, on the 1st; the warmest 37⅓°, on the 21st. The 13th was nearly the same, 37°. February had two warmer days, each 38⅔°. The entire month was 2.63° below the average for seventeen years. Only four Marches have been colder than the present during this period. The most sudden changes of temperature in 7 hours were 23°, on the 9th, 21°, on the 21st, 19°, on the 2d, and 17°, on the 14th and 16th. The least range was 3°, on the 10th.

SKY.

The face of the sky in 93 observations gave 41 fair, 16 cloudy, 23 overcast, 7 rainy, and 6 snowy, — a percentage of 44.1 fair. The average fair for the last seventeen Marches has been 50.2, with extremes of 33.3, in 1881, and 63.4, in 1883. This month has been less fair than the present but three times in seventeen years. Only five days during the month were noted fair throughout the day, and beautiful sunsets were still more rare.

PRECIPITATION.

The amount of rainfall, including 12 inches of snow melted, was 6.45 inches. On four occasions the amount exceeded 1 inch, two of which reached nearly 2 inches. The first came in the form of snow, measuring 9 inches, restoring the sleighing for three or four days. Several other storms occurred, partly snow or sleet, but ending in rain. The average amount of precipitation in March for nineteen years has been 5.15 inches, continuing March as the banner month in this respect. The amount since the 1st of January has been 20.69 inches, while the average for these three months in nineteen years has been only 14.75. The present quarter has been exceeded in this respect but once (last year) during this period.

PRESSURE.

The average barometer the last month was 29.825 inches, with extremes of 29.08, on the 22d, and 30.68, on the 5th, — a range of 1.60. This range has been exceeded in any one month but three times in fourteen years, — in November, 1873, February, 1876, and January, 1886. The average barometer for the last fourteen Marches has been 29.879, with extremes of 29.639, in 1881, and 29.991, in 1882. The sum of the daily variations the last month was 8.98 inches, giving a large average daily movement of 2.90 inches. This average for the last fourteen Marches has been .235 inch, with extremes of .198, in 1886, and 2.90, in 1887. Some of the largest daily movements the past month were .96, .86, .80, and .65. The barometer did not reach 30 inches after the 9th till the 26th, showing low barometric waves.

WINDS.

The direction of the wind in 93 observations gave 21 N., 0 S., 3 E., 19 W., 5 N.E., 32 N.W., 5 S.E., and 8 S.W., an excess of 45 northerly and 46 westerly over the southerly and easterly, and indicating the prevailing direction to have been

W. 44° 22′ N., or very nearly N.W. The westerly winds have uniformly prevailed over the easterly in March, with one exception (2 E., in 1870), for eighteen years, by an average of 39.11 observations, and the northerly over the southerly, without an exception, by an average of 23.28; indicating the approximate average direction of the wind in March to be W. 30° 46′ N. The longitudinal extremes have been 2 E. and 72 W., a range of 74 observations; the latitudinal 1 N. and 47 N., a range of 46. The relative progressive distance travelled by the wind the past month was 64.33 units, and during the last eighteen Marches 819.3 such units, — an average of 45.52; showing less opposing winds the past month than usual. In other words, the winds have been northwesterly more continuously than usual.

The month was thus unusually cold, with a large amount of cloudiness, storms, and precipitation, — a continuation of winter. The barometer ranged very low, us is usual in March, being also attended with great and sudden changes, indicating turbulent weather. The winds also were more northerly than usual, often fierce, damp, cold, and searching. Very few days, if any, were truly spring-like and agreeable. It is not surprising that such weather as generally prevailed was attended with unusual sickness and discomfort, leading many to rejoice that March, 1887, is now numbered with the past.

D. W.

Natick, *April* 5, 1887.

Errata. — In the April number, p. 59, first line under "Sky," and also under "Winds," for 93 read 84 in each case.

[Specially reported for the *Science News* from the Observatory of the College of New Jersey.]

ASTRONOMICAL PHENOMENA FOR MAY, 1887.

Mercury is not in a good position for observation. At the beginning of the month it is a morning star, about 20° west of the sun; but it is at the same time so far to the south that it does not rise until the morning twilight is too strong for it to be seen. Venus is seen as an evening star in the western sky just after sunset, far brighter than any of the stars or other planets. It is slowly increasing its apparent distance from the sun, and at the end of the month sets about three hours after sunset. Mars is too near the sun to be seen. It passed conjunction with the sun on April 24, and is now a morning star, slowly increasing its apparent distance from the sun, but will not get far enough away from that body to be easily seen for some months. Jupiter rises before sunset, and is on the meridian at a little after 11 P.M. on May 1, and at a little after 9 P.M. on May 31. It is moving slowly westward among the stars, and is nearly due east of the first-magnitude star Spica (*Alpha* Virginis), diminishing its distance from that star from about 8° at the beginning to about 5° at the end of the month. Saturn is an evening star in the western sky, setting earlier each night; by the end of the month it sets about three hours after sunset. It is moving slowly eastward, and is rather nearer Castor and Pollux (*Alpha* and *Beta* Geminorum) than it was during April. At the end of the month it is about 10° due south of Castor, the western and fainter of the pair, and about 6° south and 3° west of Pollux, the eastern and brighter. Venus is also in the same neighborhood at the close of the month, and we shall have the rather unusual spectacle of two bright planets and two first-magnitude stars all in a circle of radius about 5°. The nearest approach of Venus and Saturn occurs on May 30, when Venus passes between Saturn and Pollux, about 2° north of Saturn. Uranus is on the meridian about 10 P.M. on May 1, and 8 P.M. on May 31. It is moving slowly westward among the stars, and at the beginning of the month is about 2°, or four diameters of the moon, south of the third-magnitude star *Gamma* Virginis. By the end of the month it will be about the same distance south, and a little less than 1° west. As the planet is only sixth magnitude, it is not easy to find, except on a very clear, moonless night. Neptune passes conjunction with the sun on May 18, and cannot be seen during the month.

M.

Princeton, N.J., *April* 4, 1887.

PARIS LETTER.

Three new periodicals have been lately started in Paris: one is a medical journal, the *Bulletin Medical;* the two others are thoroughly scientific. The one is devoted to questions concerning tuberculosis, clinically and experimentally considered, and is edited by Professor Verneuil; it appears at irregular intervals, according to the supply of material. The other is edited by M. Duclaun, and concerns itself with the study of micro-organisms and parasitic diseases; it is called *Annales de l'Institut Pasteur.* Both are very good periodicals.

The diamonds of the French crown are for sale; not all, but a good part of them. The finest one, the *Regent*, as it is called, will be kept in the Louvre Gallery, with some other gems. Some have been given to the School of Mines and to the Museum of Natural History, as specimens. It is not only diamonds, but all sorts of precious stones, and gold and silver ornaments, that are to be shortly sold at auction.

A new therapeutic method is proposed for tuberculosis. It is of Russian origin, and consists of aniline inhalations. Dr. Kremjansky, who proposes it, says it is very effectual, and that it kills the *Bacillus tuberculosis* in a short time. The treatment must be kept up till symptoms of aniline poisoning set in. Nothing is known yet about the real value of this treatment. At all events, it seems much more useful to try and cure a disease to which millions yearly fall victims, than rabies, whose victims are so very few, upon the whole. It is a pity M. Pasteur did not take up the subject of tuberculosis instead of that of rabies.

At a recent meeting of the Biological Society, an apparatus was presented which was devised by a French constructor, in which a pressure of from five hundred to over a thousand atmospheres may be developed, although glass is used and required for the purpose of allowing one to see what goes on in the apparatus where yeasts or animals are subjected to this high pressure, — not rock crystal, but genuine glass, made by the Saint-Gobain manufactory.

In my last letter I spoke of *milinite*, the new gunpowder, as being a very strong explosive. In fact, it has unfortunately proved too much so, in an accident which recently occurred in Belfort arsenal, where six or seven men were killed, and many wounded. Of two of the killed, not a fragment was found.

Two important questions of hygienic interest have been recently discussed in the Academy of Medicine. One is that of lead pipes for water transportation. It has been concluded that water that only traverses lead pipes, without standing in them, cannot take lead enough to be poisonous in any degree, especially if the pipes are old ones, on account of the saline crust which forms on their inner surface. As a good precaution, however, it has been recommended to paint the interior of new pipes with a layer of some mixture which prevents immediate contact, and renders the crust-formation easier.

The other question refers to over-work in French schools, especially in young persons, and will shortly be discussed at some length. Girls preparing for school-instructorship are made to work a great deal too much, and there is not time enough provided for exercise and health.

At a recent meeting of the *Biological Society* (March 12) MM. Charrin and Roger read a paper on the toxicity of urine of different animals. That of the rabbit is nine times more poisonous than that of man, and 14 cubic centimeters are enough to kill one kilogram of animal; of guinea-pig's urine, 28 cubic centimeters are required for the same purposes; of dog's urine, 22 are necessary. In the same species, under the influence of special diet, the poisonous properties of urine vary very much. A rabbit on milk diet yields urine of which 96 (instead of 14) cubic centimeters are required to kill 1 kilogram of animal. Under the same diet, guinea-pig's urine becomes much less poisonous (78 cubic centimeters, instead of 28, are required); so does that of the dog (67 cubic centimeters instead of 22). When the animals are deprived of all food, the urine becomes much more poisonous, but at the same time it is yielded in much smaller quantity; so that, if on one hand it is more poisonous, on the other the total quantity of urine yielded in twenty-four hours kills a much smaller proportion of animal than that yielded in normal state and conditions.

The French government has recently obtained, from that of Greece, the permission to explore the ruins of ancient Delphos. It is expected that these researches will yield important results as concerns archæology, Delphos having been endowed with many galleries and specimens of art.

In a recent meeting of the Paris Academy of Sciences (31st of January) MM. Hayem, professor in the Medical School, and Barrier, of the Alfort Veterinary School, have read a paper on the effects of blood transfusion in the head of recently decapitated animals. The immediate effects of decapitation are the following (on the dog): As soon as the head is separated, the eyes are convulsively rolled about; the features exhibit a sort of surprise and anxiety; the jaws open suddenly and with force; the head seems to retain some consciousness of the exterior world, but this does not seem to last more than three or four seconds. (Three or four seconds may seem a very long time when unpleasant sensations are experienced.) After this first period the eyes sink gradually in the head, and remain motionless; but then, some sort of respiratory movements set in, induced, no doubt, by the bloodless or anoxhæmic condition of the brain, and especially of the bulb. These movements consist in the opening of the mouth and nares, as for breathing purposes; at the same time the tongue is depressed towards the fauces. These efforts are renewed from two to four times, at pretty regular intervals, during one or two minutes; at the same time the eye becomes insensible to contact and irritation, and seems to be asleep.

If, before the decapitation, the head's blood-supply is insured by the establishment of a communication with the arterial system of a living dog or horse, the phenomena are different, and the head's

death is a very slow one. If transfusion is practised some moments after the head has become entirely inert, — that is, some minutes after decapitation, — the results are the following: Some muscles, especially in the lips, begin to twitch slightly; then the respiratory efforts set in; after that the eye recuperates its reflex sensibility, first in a feeble manner, and the reflex is only unilateral, then in a marked manner, and it becomes bilateral. But the eyelids remain drooping, the head has a general appearance of drowsiness, and there is no appearance at all of any voluntary movement. This apparent return to a state of unconscious life, takes, of course, more time when the transfusion is made at a late stage; when made six minutes after the cessation of all movements, it requires four minutes to bring the phenomena back again.

These experiments show once more that death by decapitation, although very rapid, is not sudden; consciousness persists during a short time, and sensation is not thoroughly impaired; thought must be possible. However short this period may be, it may be a long one to the sufferer, and the number of ideas and sensations during those few seconds may be very considerable. H.

PARIS, *March* 26, 1887.

Correspondence.

Brief communications upon subjects of scientific interest will be welcomed from any quarter. The editors do not necessarily indorse all views and statements presented by their correspondents.

FIRES FROM STEAM-PIPES.

EDITORS SCIENCE NEWS:

MY workroom is in the basement of a seven-story building, heated by steam. The return-pipe, carrying condensed steam from the upper part of the building back to the boilers, runs through a corner of my room. Of course, such a pipe is never as hot as 212°, and is frequently hardly blood-warm. It makes a very convenient place for warming cold fingers; but, as it is occasionally too hot to be comfortably grasped by the hand, I cover it with one or two thicknesses of cloth or paper, the paper remaining on the pipe for an indefinite period. Now, the result of all this is, that the paper, after remaining on the pipe for several months, becomes scorched, brown, and brittle, crumbling under the fingers, although it can never have been heated within a good many degrees of 212°. I am sorry I cannot give more definite figures for time and temperature; but it seems to me that even this shows that a heat considerably less than that of boiling water, will, if continued for a long time, char wood that is in close contact with it.

Yours respectfully,

C. M. BOOTH.

ROCHESTER, N.Y., *March* 31, 1887.

BUTTER-TESTING.

EDITORS POPULAR SCIENCE NEWS:

A CORRESPONDENT in the February number of the *News* gives what he considers "a simple test for butter." Now, the object of this communication is, to show the invalidity of this "*test*."

All the phenomenon recorded in this test may be reproduced in absolutely pure butter, and are due to natural causes, and are by no means a proof of adulteration.

When the specimen of butter to be tested is heated, the salt contained therein, remaining undissolved, sinks to the bottom, owing to its greater specific gravity.

Most butter contains some free acid, usually butyric acid. This acid, acting upon the sodium chloride or salt, liberates chlorine; and it is due to the decolorizing agency of this gas that the difference in color observed arises. The decolorization begins nearest the salt, and gradually rises. Hoping that this explanation will keep other subscribers from falling into the error of Mr. Ewing, I remain, L. A. BLOCKMAN.

SAN DIEGO, *Feb.* 27, 1887.

QUESTIONS AND ANSWERS.

LETTERS of inquiry should enclose a two-cent stamp, as well as the name and address of the writer, which will not be published.

INQUIRIES sometimes unavoidably remain unanswered till issue of the second number after they are received.

QUESTIONS regarding the treatment of diseases cannot be answered in this column.

F. H., *New York.* — How can corks be prepared to resist the action of acids?

Answer. — The best method is to soak them in hot melted paraffine until they are thoroughly saturated, when they will become partially acid-proof; but glass stoppers should be used for vessels containing acid whenever it is possible.

M. S. L., *Ohio.* — Are we approaching, or receding, from a glacial epoch? and how many years ago did the last one occur?

Answer. — It is almost impossible to set a definite date for the last glacial period; but, according to one of the most trustworthy estimates, the glacial period commenced about two hundred and forty thousand years ago, and continued for a hundred and sixty thousand years, with mild interglacial periods. These figures may or may not be exact. The last glacial period is doubtless nearer to the present age in point of time than any "ice age" which may occur in the future.

R. B., *Texas.* — What causes the hand to move, or the tongue to speak, as the mind dictates? Does the same power govern both, or can one function be perfect and the other imperfect in the same individual?

Answer. — The nature of life, or the "vital force," is an unsolved problem. We know, that, in some mysterious manner, the impulses originate in the brain and spinal cord, and are transmitted through the nerves to the muscles; but just *how* this is done is unknown. Different portions of the brain and spinal cord apparently control different functions, and a person may be unable to move his hands, and yet talk with facility, or *vice versa*.

INQUIRER. — What is the exact atomic weight of oxygen?

Answer. — The determination of atomic weights with absolute exactness is a matter of great difficulty. That of oxygen is probably slightly lower than 16, the number 15.96 being generally accepted. Additional investigations upon this point are now being undertaken.

W. W. T., *Newark.* — What is Prout's hypothesis?

Answer. — This hypothesis assumes that the atomic weights of all the elements are whole numbers, or even multiples of the atomic weight of hydrogen, which is taken as unity. The results obtained by experiment do not support this hypothesis very strongly; but Professor F. W. Clark, who has given much attention to the subject, thinks, that, by admitting *half multiples*, or assuming the weight of hydrogen to be one-half, the apparent discrepancies may be confined within the limits of experimental errors. The matter is of great theoretical importance, but it cannot yet be considered as settled.

T. C. B., *Philadelphia.* — Yes: a pound of feathers *is* lighter than a pound of lead, as the greater mass of the feathers is buoyed up by the air to a slight degree, just as a cork is buoyed up by water. If the feathers were compressed to the same volume as the lead, or if both substances were weighed in a vacuum, of course both would have the same weight.

G. C. A., *Syracuse.* — Which will run the easier, a carriage with large, or small, wheels?

Answer. — On a level surface there will be no difference in the power required, but large wheels will pass more easily over inequalities in the roadway. Railroad locomotives designed for speed have large driving-wheels, and those intended to draw heavy freight-trains have small ones. Of course, in a single revolution the large wheels would traverse a greater distance than the small ones; but the power required to complete a revolution in the same time would be correspondingly greater. The difference is not because there is any gain in power by using large wheels, but for convenience in utilizing the power of the engine in a manner best adapted to the difference between freight and passenger traffic.

R. C. S., *Falmouth.* What is the shortest time in which a photograph can be taken?

Answer. — Under favorable conditions, a small fraction of a second is sufficient. The action is practically instantaneous. A picture of a swinging pendulum was recently taken in which the exposure could not have been more than a two hundred and fiftieth of a second.

P. J. S., *Baltimore.* — Is there any substance or mineral more valuable than the diamond?

Answer. — Very fine rubies or sapphires are more valuable than diamonds of equal weight; but fine gems, like works of art, have no fixed market value.

LITERARY NOTES.

A Treatise on Chemistry. By H. E. Roscoe and C. Schorlemmer. Vol. iii. part iii. D. Appleton & Co., New York. Price $5.00.

This part of the magnificent work of Professors Roscoe and Schorlemmer commences the consideration of the complicated but most important series of bodies known as the aromatic compounds. The subject is treated in the same thorough and scholarly manner as those in the preceding volumes of the series. We have often expressed our opinion of the great value of this work as a compendium of the latest theories and discoveries in chemical science, and can only add that it will be found indispensable as a work of reference for professional chemists and teachers of the science. Every high-school or college library should possess a copy.

Elements of English. An Introduction to English Grammar, for the Use of Schools. By George Hodgdon Ricker, A.M. The Interstate Publishing Company, Chicago and Boston. Price 30 cents.

This little book has been written with the hope of making this branch of school study less difficult, more attractive, and more useful, to young pupils. It is designed to be used in the lower grades of schools, and to prepare the pupil for the study of larger works on language and grammar. It consists of a series of lessons, treating of the parts of speech and their uses, and of the simple sentence in its various forms, fully illustrated by practical exercises composed of common words in daily use. It also contains practical lessons on spelling, capital letters, and punctuation. Directions for letter-writing are briefly and clearly given. The principles of analysis and synthesis are concisely stated, followed by brief methods of parsing.

Natural Law in the Business World. By Henry Wood. Lee & Shepard, publishers, Boston. Price 75 cents.

This little volume is a most valuable contribution to economic science; and in these days, when nearly every writer upon the subject is inclined to favor socialistic doctrines to a greater or less extent, it is refreshing to meet with one who recognizes the unvarying action of the law of supply and demand, and that the *laissez faire* policy is the only one compatible with the highest happiness of the greatest number. The belief of the author, that the State should inspect and regulate the sale of articles of food and medicine, is, we think, erroneous; but, with this exception, there is but little in the work which is not worthy of the highest commendation. It is well worthy of a perusal by all interested in political or social problems.

The A B C Spanish Phrase-Book, published by Cupples, Upham, & Co., Boston (price 50 cents), will be found a great convenience to tourists in Cuba, Mexico, or any of the Southern or Central American countries.

The Open Court, published at Chicago at $3.00 per year, is the successor of the old Boston *Index*. Its object is announced to be "the establishment of ethics and religion upon a scientific basis." The first four numbers are of unusual interest, and include numerous essays by distinguished Liberal and Unitarian clergymen.

Pamphlets, etc., received: *Proteus*, by E. M. W.; *Circular of the Progressive Spelling Association of Philadelphia*; *Journal of the Trenton Natural History Society*; *The Meigs Elevated Railway*, by Joe V. Meigs; *Announcement of the Cooper Medical College of San Francisco*; *Address delivered at the Semi-Centennial Anniversary of the Medical Department of the University of Louisville*, by David W. Yandell, M.D.; *Notes on Minor Surgery*, by Edward A. Otis, M.D.; *Specialism in Medicine*, by R. R. Bunting, M.D.; *Remarks on Menstruation*, by William M. McLaury, M.D.; *Reports of the Agricultural Experiment-Stations of Massachusetts, Connecticut, and Georgia*; and the *Circulars of the U.S. Department of Agriculture and Bureau of Education*.

Medicine and Pharmacy.

SOME FACTS CONCERNING THE HUMAN BRAIN AND MENTAL PHENOMENA.

IV.

In our discussion of mental phenomena we have found that there is a nice distinction to be made between *instinct* so called, and that process of reflex action which requires the co-operation of the hemispheres, or cerebrum. It is here that the nervous impression, conveyed to the *tuber annulare*, is not only converted into an instinctive action, but, following the course of the fibres to the cerebrum, it there gives rise to a special train of ideas. We then understand the external source of sensation, — how it will affect us, and how, by our actions, we may turn it to our advantage or not. This we call *reasoning*. The action or result does not necessarily immediately follow the sensation; but there is an intervening process which we call *intellectual*, as distinguished from *instinctive*. This reasoning process, as we have already said, finds its highest type in man because of the superiority of his nervous organization, as seen in the size of the brain and the disposition of the gray substance.

This process in the lower animals is, of course, feeble; but facts compel the admission that the reasoning faculty exists, and numerous instances will recur to any observing person where animals have acted from reflection and for a definite purpose.

M. Ernest Menault, in his work entitled *The Intelligence of Animals*, gives numerous anecdotes of the reasoning faculty in animals; and his inferences and conclusions are interesting and suggestive.

Of course, he is an earnest advocate of the doctrine of intelligence; and he holds that there is an intimate connection between the organization and the intellectual faculties.

Some of the illustrations of this brilliant author may be of interest in this connection.

Old animals are more cunning than young ones. A bird's nest is often injudiciously placed and badly made. Little by little the work is improved, and the feathered artist attains his ideal. By the exercise of memory combined with reflection, the creature modifies its facilities, and therefore is, within limits, most certainly perfectible.

The acme of insect acuteness is attained in the bug *Cimex*. He is a sharp customer. A tale of one is told, who, not being able to reach his man in any other way, climbed up the wall, crawled along the ceiling to the spot exactly vertical to his victim, then, trusting to the force of gravity, let go his hold, dropping precisely upon the juicy tissues of the nose that he wished to tap. And the author *naïvely* asks, "Was that particular cimex an idiot, or was he not?"

The ass is one of Menault's favorites, and he will not allow one word said against him. The ass is *not* a slovenly water-carrier, nor a blockhead, nor a coarse peasant, nor a low-minded creature. On the contrary, he is excessively neat in his person, and grumbles at his master's not grooming him better.

The ass *is* intelligent, and here is a proof. A Chartres ass often went to the Chateau de Gréville, whose occupants were musical people. The lady of the house had a splendid voice; and, as soon as she began to sing, the ass went close to the house, and listened at the open window. One day when she was practising a *bravura* alone, her performance so delighted her long-eared listener, that he walked up the steps, crossed the entrance-hall, and stole into the drawing-room unperceived. In the midst of the most brilliant passage, when his mistress was deep in the intricacies of a *roulade*, the ass expressed his approval by braying with all his might and main.

Erasmus, therefore, was wrong in saying that the cruciferous animal has small taste for music; although he admits, as an extenuating circumstance, that his skin is excellent for kettle-drums, and that his *tibias* make the best of clarionets.

The excellence of the donkey's memory is shown by an anecdote of English origin. In March, 1816, a donkey was put on board the frigate "Ister" at Gibraltar, to be taken to Malta. The vessel, when off Cape Gata, was grounded on a sand-bank not far from shore. A part of the cargo was discharged; and, to give his donkeyship a chance for his life, he was gently dropped into the sea to sink or swim. Some days afterward, when the gates of Gibraltar were opened in the morning, in walked the donkey, proceeding straight to the stable where he was previously lodged. It was supposed, that, for some reason or other, the animal had not been put aboard the "Ister;" but, when the vessel returned, the mystery was explained. Not only had the donkey (Valiant by name) swum to the shore, but, without guide, compass, or travelling-map, had found his way from Cape Gata to Gibraltar, a distance of more than two hundred miles, through a hilly country which he had never traversed before, and in a track cut up by many water-courses. The short time in which he performed his journey proved that he had taken the direct route, keeping in it without ever going out of his way. But it hardly comes within the scope of this discussion to multiply these interesting incidents. They are simply cited in their relations to the higher and more perfect organism and function of the human brain. Nor can we, in this connection, analyze the theories of life and vital action as advanced and elaborated by distinguished modern scientists, — the theories of natural development and natural selection, and spontaneous generation; theories that attribute vital action to purely physical causes; theories which declare that "life depends for its physical basis upon the evolution of living protoplasm, from *not*-living matter;" that all living *powers* are cognate, and that all living *forms* are fundamentally of one character. These questions, though logically related to our theme, are quite too broad to come in here for discussion.

It is but fair, however, to add, in conclusion, that much of the materialism charged upon Professor Huxley no doubt arises from his insisting upon the materialistic terminology in all his scientific utterances. Hear him in his own defence: —

> If it is certain that we can have no knowledge of the nature of either matter or spirit, and if the notion of necessity is thrust into the perfectly legitimate conception of law, the materialistic position that there is nothing in the world but nature, force, and necessity, is as utterly devoid of justification as the most baseless of dogmas; with a view to the progress of science, the materialistic terminology is in every way to be preferred.
>
> But the man of science who slides from these formulæ into materialism seems to me to place himself on a level with the mathematician who should mistake the *x*'s and *y*'s with which he works his problems for real entities; and with this further disadvantage, as compared with the mathematician, that the blunders of the latter are of no practical consequence whatever, while the errors of *systematic materialism* may paralyze the energies and destroy the beauty of a life.

PAIN AND ITS USES.

We all know what pain is, but to give a scientific definition of it has taxed the brains of lexicographers and encyclopædists. An eminent physiologist calls it "an excess of the sense of touch;" and another, "hyperæsthesia of the sensory fibres." Dunglison, in his *Medical Dictionary*, says it is "a disagreeable sensation, which scarcely admits of definition:" and Gardner, in his work of the same title, under "Pain," says "See Dolor;" and, turning to "Dolor," we find it concisely explained as "pain." The great French *Dictionnaire des Sciences Médicales* coolly and conveniently tells us that to define it is superfluous. Professor Erb, in Ziemssen's *Cyclopædia*, after some discussion, comes to the conclusion that pain is a new sensation, "experienced when excitation of the nerves reaches a certain intensity." Perhaps the *Imperial Dictionary* covers the ground in describing it as "an uneasy sensation in animal bodies, of any degree from slight uneasiness to extreme distress or torture, proceeding from pressure, tension, or spasm, separation of parts by violence, or any derangement of functions."

It is said that Sir Humphry Davy, when a boy, held the opinion that pain was no evil; but that, when a crab bit his toe while bathing, and made him roar loud enough to be heard half a mile off, he was converted to the opposite view. It is easy to philosophize upon pain and other bodily or mental evils when we are free from them, but a brief experience of their power is apt to refute all our calm reasoning.

It is true, nevertheless, that our very existence depends upon our sensibility to suffering. A temporary suspension of this sensitiveness may be attended with fatal effects. There is a well-authenticated story of a drover in England who went to sleep one winter's night on the platform of a lime-kiln, with one leg upon the masses of limestone piled up for burning during the night. When he woke up in the morning, he found his foot burned off above the ankle. It

was thought that he had been rendered insensible to pain by the carbonic acid from the decomposing limestone; but, whatever may have been the cause of his strange torpor, he paid the penalty with his life, for he died a fortnight after in a Bristol hospital in consequence of his injuries.

Without the warning due to pain, life would be a series of similar disasters. The crab might have eaten off young Davy's foot, and the wound might have been the death of him, to the eternal detriment of chemical science; or, if he had escaped the greedy crustacean, he would probably have perished from the inhalation of carburetted hydrogen at the time when the terrible oppression in his chest warned him of the risk he was running, which, as it was, very nearly proved fatal.

Children, like other young animals, soon learn to profit by the lessons of pain. The burnt child dreads the fire, according to the old saw, and a kitten does not touch the hot stove more than once with its paw. Lord Kaimes, however, maintained that some direct instruction in this line was desirable for the young folk, and advised parents to cut the baby fingers "cunningly" with a knife, that the idea of suffering might be associated with the shining blade before the youngling had unwittingly done itself worse harm therewith. If it were not for the pain, the child would be in danger of whittling its fingers, instead of the stick; or burning them, instead of the seductive match it delights to get hold of.

We referred, in the last number of the *News*, to the necessity of limiting muscular exercise to the amount that the sensation of exhaustion indicates to be a sufficient strain upon the strength for the time; and this suggests another important use of pain. Without the warning that it gives us, we should soon maim or kill ourselves from over-exertion, wearing out our muscles with no more care or thought than we do the tools we use.

There would be a like risk in eating and drinking. Some people are not prompt enough to heed the admonitions against gluttony and drunkenness which stomach and brain now give them. If these admonitory pains were unknown, we should all be liable to dangerous excesses from the temptations of appetite. The epicure would be a dyspeptic before he knew it, and his digestion might be hopelessly ruined before it occurred to him to call in the doctor. How rarely, indeed, would the doctor ever be called in season, were it not for the hint that our painful sensations give us of the imperative necessity for his services. Pain is the sentinel that watches perpetually over our safety, and gives notice of the first approach of the diseases, which are our worst enemies. Remove the sentinel, and the foe would surprise us before we were aware that he was near, and would be in full and fatal possession of the very citadel of our existence before we could make the least attempt to resist him. This warder on the walls of our human habitation may often annoy us by waking us from our comfortable sleep and pleasant dreams; but he is a loyal servant and a faithful friend in rousing us to defend ourselves against the insidious ills that flesh is heir to.

DISTILLED WATER IN EYE LOTIONS.

Physicians and pharmacists generally assume that distilled water is the best means of dissolving or diluting drugs, and in the great majority of cases this is undoubtedly the case. As a rule, the solvent should be absolutely pure and neutral in itself; but in some instances this very neutrality of the solvent may interfere with the intended action of the substance dissolved. A curious illustration of this exception to the rule was given some time ago by an eminent English oculist in a communication to a London journal. Our readers know that an aqueous solution of boracic acid is one of the most useful of eye lotions; but we remember, that, as prescribed for the writer several years ago by one of the best oculists in this city, the order was for "ten grains in *distilled water.*" Our English expert, however, says he has found that, when the lotion is made of distilled water, its use is attended with some discomfort and smarting; and, what is more singular, the irritation is even greater when there is no boracic acid in solution. "Anybody," he says, "can verify for himself that a drop of distilled water in the eye seems to be a most unpleasant and foreign element."

The simple explanation of this is, that well or spring water contains salts in solution which make it slightly alkaline, thus rendering it somewhat more neutral to the *conjunctiva*, a tissue ordinarily bathed in the lachrymal secretion, which contains about one per cent of solids, chiefly chloride of sodium, or common salt. The addition of two grains and a half of this salt to the ounce of distilled water renders any lotion for the eye more soothing and more beneficial. This, our friend says, he has verified by experience; and we commend the fact to the attention of oculists and others interested.

MONTHLY SUMMARY OF MEDICAL PROGRESS.

COMPILED EXPRESSLY FOR THE SCIENCE NEWS BY W. S. WELLS, M.D.

The aspirator, an instrument invented by Dieulafoy for the exploration of cavities and the evacuation of fluids therefrom, is having the area of its usefulness extended.

Dr. George Foy, Dublin, relates the case of a man to whom he was called one night, and who was reported to be dying. He had taken a large quantity of whiskey and claret; and for two hours his drunken companions had been trying to rouse him, but had totally failed. When seen, he was quite insensible; extremities cold, face livid, pupils widely dilated, respiration and pulse almost imperceptible. Treatment was commenced by opening the median-basilic vein of the left arm, when, by rubbing the forearm briskly, the blood gradually flowed until sixteen ounces were drawn off.

In the mean time the fine trocar of an aspirator was pushed through the abdominal wall into the stomach in an upward and backward direction, just at the sternal end of the eighth rib. The canula was attached by the ordinary method to an exhaust-bottle; and, on turning the cock, a stream of claret-colored fluid flowed into the bottle. Very soon the heart began to beat more perceptibly, and the pulse was readily felt at the wrist as respiration and circulation improved. The canula was then withdrawn, and a stomach-pump was used to wash out the stomach. In a short time the man could speak, and soon recovered. Dr. Foy saw no reason to give apomorphia in this case, as it has no emetic action when sensibility is quite deadened; and he did not consider it safe to use a stomach-pump while the respiration was so feeble; hence he emptied the stomach of its alcoholic surplus through the aspirator.

The use of the aspirator in cases of retention of urine is not so rare as the foregoing resort to it for drunkenness; but the following, by Dr. Fairbanks of Bristol, England, deserves notice: The patient, aged seventy-six, had suffered for some weeks from trouble in micturition, when he was seized with complete retention, which was relieved for three days by the catheter; and then, difficulty having arisen in passing the instrument, Dr. Fairbanks was called in. It being impossible to pass a catheter, and the symptoms being urgent, the aspirator was used. For the next fifteen days the whole of the urine, with the exception of that drawn off on one occasion by the catheter, was passed through the needle of the aspirator. In all, the bladder was aspirated thirty-two times. After this a catheter was able to be introduced, and by degrees the patient obtained control over his bladder. From the doctor's experience in these cases, he never hesitates to aspirate if a catheter cannot be easily introduced, when the symptoms are urgent.

Professor George Buchanan, Glasgow, records a case of salivary fistula cured by the galvano-cautery, in the case of a lady who had, thirteen years previously, suffered from an enormous carbuncle situated on the left side of the neck, below the ear, extending to the cheek over the parotid gland. A free incision had been made, and the parts almost completely cicatrized; but below the lobe of the ear a little sinus remained, from which a small quantity of semi-purulent watery fluid exuded. Every time mastication was performed, some drops of saliva issued from the fistula below the ear. A platinum-wire loop was shortened, and pressed together so that the two sides of the loop were in contact, and together were not thicker than a small probe. The wire was placed on the exact spot of the fistula before it was heated, and held firmly there whilst heated by the electric current. An eschar, the size of two pins' heads, was produced by the wire, and a fortnight later the sinus was completely healed.

In the treatment of asthma, Dr. Cazanave de la Roche has found iodide of potassium, associated with cow's milk, very efficient, and gives the following formula: Distilled water, a hundred and fifty grams; iodide of potassium, eight grams: one tablespoonful of the solution in a cup of milk, twice a day.

In the treatment of acute fevers, Semmola of Paris prescribes glycerine diluted with water, to be taken in copious drinks during the day; at first fifteen to twenty grams for every twenty-four hours, dissolved in four hundred to five hundred grams of water, to which are added a few spoonfuls of lemon-juice or a few grams of citric acid. The following is the formula: Pure glycerine, three hundred grams; citric or tartaric acid, two grams; water, six hundred grams.

Twenty to thirty grams of this mixture, fur-

ther dissolved in water, to be given every hour. Under the influence of this drink the quantity of urea is diminished.

M. Foulerton records a case, in the *London Lancet*, of poisoning by benzoline vapor. A well-developed man, aged twenty-five, entered a tank used for the storage of benzoline at nine A.M., — the tank was all but empty, — and at eleven A.M. he was found insensible at the bottom.

The tank was exposed to the direct heat of the sun, a thermometer inside registering 105° F. When seen by the doctor, the patient was unable to stand; he could answer simple questions, was moaning occasionally, and from time to time burst into a hysterical laugh. The surface of the body was cold and clammy; muscular tremors and twitchings were present in the arms and legs. Pulse, 88; respiration, 8 to 9 a minute, deep and stertorous; temperature, 98.8° F. Twenty-five minims of solution of ammonia, with half a drachm of ether, was administered at once; the patient being put to bed, and wrapped in blankets, with hot-water bottles to his feet.

Very soon another half-drachm of ether was given, together with frequent half-drachm doses of aromatic spirit of ammonia. For two hours the patient did not seem to rally; but after that he improved, and by evening was quite well, except that he complained of slight headache. Remarking upon the case afterward, the doctor expressed his opinion that a little blood-letting would have been good, as the right side of the heart was distended; and, if ever he had to attend such a case again, he would rely on external warmth, together with moderate bleeding and the free use of ammonia.

In various affections of the eye, Juquer of Paris uses iodol, on account of its emollient qualities. It aids the cicatrization of wounds, just as iodoform does, but is without the irritating properties and disagreeable odor peculiar to the latter. He found iodol especially useful in the treatment of impetiginous eczema of the eyelids; in ulcerations of the palpebral borders and of the external canthus; in phlyctenular or pustular conjunctivitis; and also in ulcerations of the cornea, whether primary or secondary; in chronic affections of the lachrymal ducts; in suppurative dacrocystitis; and in periosteal affections.

In cases of impending death from chloroform, Bergman, the eminent German surgeon, executes a manœuvre upon which he lays great stress. While his assistants rapidly perform the movements necessary for artificial respiration, he introduces his finger into the mouth, and holds up the epiglottis. He claims this valve to the entrance of the windpipe will often close down firmly, so as prevent entrance of air into the lungs, and that artificial respiration will be useless if the opening is not maintained. It would seem, from this, that Bergman does not believe the forcible protrusion of the tongue sufficient to hold the epiglottic fold open.

Dr. John Reid, Melbourne, Australia, gives another communication on drumine, recommending this alkaloid for catarrh of the stomach and duodenum, — indicated by dark motions and griping pains, — common in hot weather and after draughts of cold water. He has found it useful in other catarrhs.

A Parisian writer (*Jour. de Méd.*) recommends a new collodion, which is antiseptic, and facilitates cicatrization, and is superior to gun-cotton collodion in the treatment of wounds and bruises. It is prepared according to the following formula: Mastic in globules, three grams; balsam of Peru, one gram; narcotine, one gram. Each substance is separately ground. Five grams of chloroform are added. The mixture is shaken from time to time, and allowed to rest after solution. It is used the same as other collodion, by painting the parts with it; also has been found useful as a topical application in neuralgic and rheumatic pains.

A new method of lead-poisoning is pointed out by Dr. I. E. Atkinson, Baltimore, occurring among marble-workers, who use a powder of lead, zinc, and oxalic acid for polishing the marbles. The treatment consisted in administering alum, twenty grains in solution, every third hour, and was successful.

Ergot has been used in France for arrest of the sweats of phthisis, and has since been found by Dr. Farmwell, Virginia, very efficacious in the diarrhœa of this disease.

Styptic Paper, much used abroad, is made by mixing, with the paper pulp, one part of solution of ferric chloride to an equivalent of pulp that will yield four parts of dry product, or one part of tannic acid to eight parts of finished product, and carefully drying the same. When made on a small scale, white absorbent (or blotting) paper may be used and made into pulp, to which the astringents are added, and then carefully dried. It forms an excellent means of stopping bleeding by simply binding on a small quantity of the prepared paper.

The following is considered a more efficacious and convenient remedy for the removal of warts than other recommended procedures. Take fifteen grains of corrosive sublimate, and dissolve in one ounce of collodion. Brush the warts carefully once a day with this solution.

Poisonous ptomaines, sufficient to cause toxic symptoms, are liable to arise from the placing of milk, warm from the cow, directly into tight cans, subjected to a warm atmosphere.

Cool the milk first before canning, and keep cans in cool temperature afterward. It is always safe to boil milk for family use, and put it aside to get cold before bringing to the table.

Cocaine is recommended as a heart-tonic and stimulant in low adynamic fevers. The dose is one-quarter of a grain, *pro re nata*.

Anæsthesia of the eye, for the removal of foreign bodies from the cornea, has been successfully accomplished by M. Ferrier by the use of muriate of caffeine, which was found to be a perfect substitute for cocaine.

[Communicated to the *Science News*.]

POISONING BY POISON OAK AND POISON VINE.

Rhus Toxicodendron, commonly known as poison oak, is an indigenous shrub growing in low, wet, uncultivated ground, with other small trees in the greater part of the United States and in Canada. It seldom exceeds three feet in height; its root sends up many stems, which divide into slender, woody branches. The bark is of a brownish-gray color. The leaves are trifoliate, oval, or rhomboidal. The flowers are small, of a greenish-white color, and grow in axillary racemes. The fruit consists of a roundish, dry, smooth, poisonous berry, of a pale-green color, and containing a solitary bony seed.

The *Rhus radicans*, termed poison vine or poison ivy, is merely a variety of the *Rhus toxicodendron*. But, instead of having an erect stem, it becomes a climber, and grows in close proximity to trees, fences, and walls. Its stem is woody, and near its base is ofttimes three or four inches in diameter. Its leaves are quite entire, ovate, and acute; smooth and shining on each side, with the exception of the veins beneath. Its fruit and flower resemble the erect variety. These plants flower from May to August. The leaves are inodorous, and have a saline, acrid taste. They are the parts generally used for medicinal purposes. Water and alcohol extract their properties. Both forms, when wounded, emit a milky juice, which turns black on exposure to the air, and has been employed as an indelible ink. It is soluble in neither water nor alcohol. Ether, however, dissolves it. This juice, and even the exhalations from the plants, are extremely poisonous to many persons, attacking the cutaneous surfaces, and producing a burning itching, with redness and swelling of the parts, especially the face, succeeded by vesication and desquamation of the cuticle, heat, pain, and ofttimes fever. These symptoms, though highly distressing, are rarely fatal. Many persons, however, are not susceptible to its poisonous action, and may break and handle the stems without experiencing the deleterious effects.

Numerous remedies are given for this troublesome eruption, many of which have been proven highly beneficial. A light, cooling regimen, and in most cases cooling purgatives or diuretics, are necessary. A weak solution of table-salt or a cool solution of sugar of lead applied externally has long been used to advantage. A physician in a recent issue of a medical journal states that he has never failed to kill the poison of these plants with a strong aqueous solution of sulphate of iron; and I have used an aqueous solution of sulphate of copper with good results, but deem these remedies a little harsh in their action. In my estimation, bromine and grindelia are the best remedies for poisonous eruptions. They are well worthy of a trial by those who are afflicted with this troublesome complaint. Bromine is claimed to be a specific. To use it, it may be dissolved in either olive-oil, cosmoline, or glycerine, — ten to twenty drops of bromine to an ounce of oil, — and should be applied to the affected parts three or four times daily, and especially upon retiring. A new solution should be made at least every twenty-four hours, or the strength of the bromine will be lost, on account of its volatile properties.

Equally good results are claimed for the grindelia. The best way of using it is, to mix one or two teaspoonfuls of the strong fluid extract of *Grindelia robusta* in half a tumbler of cold water, and apply freely to the affected parts with a sponge or cloth dipped in the mixture. I have known cases where two or three applications have sufficed for a cure, but a longer time may be needed if the affection has been of long duration.

Where the mucous membrane of the air-passages is affected, and where the eruption occurs about the eyes, the application of witch-hazel will be found cooling and beneficial.

J. H. E.

EFFECT OF CHANGE OF CLIMATE UPON INDIANS.

The following note of the transfer of the Chiricahua Indian prisoners of war from Fort Apache, A.T., to St. Augustine, Fla., is furnished by the surgeon who was in medical charge of the party: "The general health of the troops and prisoners during the entire trip was excellent. Of the troops, it may be said there was no sickness, there being only a few cases of constipation and diarrhœa; but these yielded at once to treatment, and were not such as

necessitated taking the soldier off duty. Of the twenty-five Indian scouts, none were sick. Of the Indian prisoners, several suffered with intermittent fever, — men, women, and children. This, in my opinion, was contracted at Camp Apache from an unhealthy encampment. They were living on the banks of a stream which the summer rains transformed into marshes filled with rank vegetation, thus giving rise to the malarial poisoning. By the use of quinine they had very much recovered before reaching St. Augustine. Many of them were troubled with diarrhœa while *en route*. This was, doubtless, owing wholly to dietetic causes. Some of them brought fresh beef on the train, and, having no way to cook it, ate it dried; others were not accustomed to the hard bread and canned beef issued on the cars; while others ate freely of watermelons, for which they bartered trinkets while *en route*, all of which causes were instrumental in producing irritation of the bowels. However, they all arrived much improved, except one woman, who was very old, and appeared, though not suffering with any disease, exhausted by the trip.

"It was noticeable, that, when the command arrived in Kansas, many of the Indians, chiefly men and children, were attacked with epistaxis. It seems very singular, in view of the fact that they are people who live in the mountains at a high altitude, and were going to a lower one; while the same trouble affects those coming from the East to the rarefied air of higher altitudes.

"Several of the officers were attacked with 'colds,' but not until they reached the warm, moist, and to them oppressive, air of the South, almost at the sea-level." — *Sanitarian.*

A MOVABLE SHEET FOR THE SICK.

I HAVE found the following a valuable arrangement for a bed for the sick needing change of position, where there is inadequate assistance, or, as is often the case, a weak nurse to perform the labor, or in cases of surgery, where the safe and easy movement of the patient is necessary: —

Fasten smoothly to the mattress, with strong safety-pins, a rubber blanket or piece of enamelled cloth, rubber or enamel side up. Upon this, place a similar rubber or enamelled cloth, if possible somewhat wider, so as to *always* keep the under one covered. Cover with a sheet, and make up the bed as usual. Between the rubber or enamelled surfaces sprinkle soapstone powder, kept by all shoedealers, or glove-powder; or, if nothing better can be had, the common graphite, known as stove-polish, will do. Now, by grasping the edge of the under sheet and upper enamelled cloth at the same time, it will be found easy to *roll over* or move the heaviest person with slight effort, and little pain or straining, either to nurse or patient.

If the device prove too slippery when not wanted, a few strong pins fastening it to the bedding beneath will prove sufficient to prevent it.

EDW'D P. ROCHE, M.D.

MEDICAL MEMORANDA.

ARSENIC-EATING. — According to a foreign exchange, arsenic-eating has long been practised among the inhabitants of an Austrian province, and recent investigations show that the habit has spread among both sexes. According to an Austrian doctor, who recently examined the physical and mental condition of several arsenic-eaters, the presence of arsenic in the urine showed the average dose of the drug taken daily to be thirty milligrams. Physically, some of the arsenic-eaters were thin, others normally stout, and the arsenic habit did not appear to prevent the formation of fat. In several cases the cause of the habit was alleged to be the strengthening influence of arsenic on the digestive organs. None of the eight cases under examination showed symptoms of slow, chronic poisoning. The drug is principally taken in order to facilitate respiration when climbing steep mountains, and it is said to answer the purpose exceedingly well.

CREMATION. — The New York Cremation Society reports that there have been nearly two hundred incinerations at its crematory during the past year. The total membership is nearly two hundred, and the society is financially prosperous. The president remarks, in his annual report: "Considering that it is yet but a feeble minority who prefer to give their bodies to the element of fire to purify and consume, instead of giving them to foul the other three elements, we must admit that it is very generous of the majority to let us have our own way, which we trust will soon be the way of all."

THE FUNCTIONS OF THE LIVER. — Minkowsky cut the liver out of geese, and studied the changes in the process of nutrition. He found that the blood did not contain any sugar, but lactic acid, leucine, and tyrosin. The animals did not produce less heat, but death resulted from the production of a poisonous substance in their intestines. The urine of these geese contained much less uric acid, and more ammonia, than that of normal geese; which seems to corroborate the theory that uric acid is produced in the liver.

MARINE PURIFICATION. — MM. Morean and Miguel show that the sea rapidly purifies the pestilential atmosphere of continents. Marine atmospheres driven upon land act upon inland places to a considerable distance, purifying the air of the regions they traverse.

HUMORS.

HOPELESS. — Sir Astley Cooper used to relate the following anecdote of an Irish candidate before the Examining Board of the London College: "What is a simple, and what is a compound fracture?" asked the examiner. The reply was: "A simple fracture is when the bone is broken; and a compound fracture, when it's all broke." Sir Astley asked him what he meant by "all broke." "I mean," he replied, "broke into smithereens, to be sure." "I ventured to ask him what was 'smithereens.' He turned upon me with intense expression of sympathy upon his countenance. 'You don't know what is smithereens? Then I give you up!'"

"A CASE IN PRACTICE." — The young men attending the Harvard Medical School have a prejudice against the female students, one of whom they called to attend a case of fracture of the leg. The patient was a man fifty years old; and, when the lady exposed the damaged member, she found it to be a broken wooden leg. She sent for a hammer and nails, made substantial repairs, and charged twenty-five dollars, the collection of which she enforced by the aid of a constable.

EARTHQUAKE PILLS. — At the time of the Lisbon earthquake, a Spanish quack advertised pills against earthquakes. This field of industry has been sadly neglected by American patent-medicine men. That is because we have earthquakes in this country without taking pills.

TO INSPIRE CONFIDENCE. — A dentist in Mexico had a patient who was timid about having a tooth extracted. To show him that the operation amounted to nothing, the dentist called the boy who wielded the mallet, and, telling him to open his mouth a minute, pulled at one of his teeth. The patient was not reassured, and the dentist lost his small boy.

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SETH C. BASSETT,
MANAGER.

Publishers' Column.

FOR writers' paralysis, use a rubber penholder and Esterbrook's turned-up-point pens, Nos. 309, 256, and 1876.

DR. J. F. TOWNES, Ada, Tenn., says: "I find HORSFORD'S ACID PHOSPHATE a valuable reconstructive agent, repairing the system, aiding digestion, fertilizing the brain and nervous system."

THE preparations of the HEALTH FOOD COMPANY of this city are worthy of a trial. They are not medicines, but true foods, prepared from choice grains, and adapted to all conditions of the digestive and nutritive functions.

THE PHYSICIAN'S COMPANION SYRINGE, sold by the TYER RUBBER COMPANY of this city, is provided with six different pipes, suitable for every purpose for which such an instrument is required. It is indispensable to physicians, and is sold at a very moderate price.

I HAVE used, with flattering results, COLDEN'S LIQUID BEEF TONIC as a food in a variety of cases, — notably in cases of gastric irritability, and such acute inflammatory conditions of the gastric mucous membrane.

S. H. FRAZER, M.D., *St. Louis.*

THE GURNEY HOT-WATER HEATER COMPANY of Boston, Mass., has just published a work entitled "How to erect a Hot-Water Heating Apparatus," for the information of steam-fitters and plumbers, and those who desire more knowledge respecting this system, and will be pleased to furnish a copy upon application to their address, 237 Franklin Street, Boston. John A. Fish, Managing Director.

PORTLAND, ORE., Sept. 3, 1886.

MR. DAVID BOYLE, *Chicago, Ill.*

Dear Sir, — The machine has done very well this season, and we are very well satisfied with it and its work. The demand for ice has been good, and we have been compelled to run to our full capacity to supply our trade. The ice gives *better* satisfaction than natural ice.

Yours truly,
PORTLAND ARTIFICIAL ICE COMPANY,
G. A. CRAW, *Sec'y.*

A SUMMER SCHOOL OF GEOLOGY will open on the 6th of July next at the Museum of Comparative Zoölogy in Cambridge, Mass. It will be under the charge of Professor N. S. Shaler of Harvard University, assisted by Mr. T. W. Harris. The course will comprise illustrated lectures, laboratory work, and excursions to regions of geological interest. The course is especially adapted to the needs of teachers, and an advanced knowledge of the subject will not be required. A circular giving full particulars will be sent upon application to Mr. T. W. Harris, Divinity Hall, Cambridge, Mass.

SCIENCE will be well represented, as usual, at the Martha's Vineyard Summer Institution, during the coming season. There are departments of Botany, Chemistry, Geology and Mineralogy, Geography (including Physical Geography), Microscopy, Physics and Manual Training, Physiology and Physical Culture, and Zoölogy, all under the charge of teachers who are experts in their respective branches. The work is largely of a practical character, and is specially arranged to take the student out of doors as much as possible, thus combining bodily exercise and recreation with study and investigation. The locality is particularly favorable for open-air work of this kind. Teachers will find it a means of augmenting the pleasure and profit of the vacation itself by introducing into it just enough of labor to give zest to the recreation. For circulars, address B. W. Putnam, Jamaica Plain, Mass.

The Popular Science News

AND

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CONTENTS.

FAMILIAR SCIENCE. — A Famous Old Perfumer 79
Simple Scientific Experiments 80
Field Geology 80
Natural History Notes 82
Niagara in Winter 82
Scientific Brevities 83
PRACTICAL CHEMISTRY AND THE ARTS. — A Water-Pump for the Laboratory 83
A Curious Explosion 83
Photograph of a Mirage 84
A Convenient Substitute for Sealed Tubes for Heating under Pressure 84
A Bomb Test 85
Easy Chemical Experiments 85
HOME, FARM, AND GARDEN. — Chemistry of the Cooking-Stove 85
The Mysteries of Plant-Growth 85
Baked Beans 86
A Scientific Schoolboy 86
Household Hints 86
EDITORIAL. — The Possibilities of the Future 87
Popular Scientific Superstitions 88
Astronomical Phenomena for June, 1887 88
Meteorology for April, 1887 88
Fires from Steam-Pipes 89
Ivy-Poisoning 89
Questions and Answers 89
Literary Notes 89
MEDICINE AND PHARMACY. — Slow Mental Development as seen in "Dull Boys" 90
House-Drainage 90
Monthly Summary of Medical Progress 91
An Improvement in Stethoscopes 92
Publishers' Column 92

Familiar Science.

A FAMOUS OLD PERFUMER.

THE ancient city of Cologne, the *Colonia Agrippina* of the Romans, has had in modern times a curiously "mixed" reputation. It has given name to the most popular of perfumes, while the familiar epigram of Coleridge has associated it with the

> "Two-and-seventy stenches,
> All well defined, and several stinks,"

which he says he "counted" when there some fifty or more years ago. Whether Cologne was dirtier than other German cities in that day, we do not know. No doubt it was dirty enough, and its bad name has stuck to it in spite of the sanitary improvements of recent years. It is now as clean as the average Continental city, but the fling of the English poet still makes the tourist sensitive to the stenches that linger in its narrow streets.

The perfume which is named from the old Rhenish city dates back a century, at least, before the rhymes of Coleridge; and the grave-looking personage whose portrait accompanies this article is renowned as its inventor. The likeness was engraved in England some ten years ago from an oil painting which may be seen in the establishment of the Farinas, "opposite the Julich's Place" in Cologne.

Giovanni Maria Farina was born at Santa Maria Maggiore, in the north of Italy, in the year 1685, but emigrated in his early manhood to Cologne, where he became naturalized as a citizen, and changed his first name to the German form, Johann. He is known to have been in business "opposite the Julich's Place" in the year 1709. "Kölnisches Wasser" (German for "Cologne water") must have been invented before that date, as it is mentioned in records of the house for that year, which are still in existence. In 1726 the trade in it was so large that Johann sent to Italy for his brother Giovanni Battista (John Baptist), who became his partner. John Baptist died in 1732; and John Maria, being a bachelor, took as a partner his brother's son, who was

luckily named John Maria. In the fulness of time — in point of fact, in 1766 — the elder Farina was gathered to his fathers, and John Maria the Second became the head of the concern. He continued to make and vend the fragrant water until 1792, when he died, — presumably "in the odor of sanctity," — leaving the business to three sons, one of whom had been duly christened John Maria. This one died prematurely; but both his brothers took care to name their eldest sons John Maria, and these grew up, and succeeded to the proprietorship of the house. One of them died in 1833, but we believe the other is still the senior in the firm; while his son John Maria is associated with him as junior partner. Probably the latter has a son of the same name, who is destined to be his successor; and we may expect that John Marias will follow in the Farina family to the last syllable of recorded time, and "continue the business at the old stand."

As might have been anticipated, the success of the original John and his perfumed waters attracted other Italian Farinas to Cologne. In 1750 several new firms of the name were established there; and during the Seven Years' War, when the French army occupied the Rhenish provinces, sundry bottles of *eau de Cologne* were among the plunder carried back to Paris. The perfume at once became a favorite in France, and a John Maria Farina from Düsseldorf soon began its manufacture in the capital. When the "veritable" John Maria of Cologne subsequently established a branch house in Paris, a suit was brought against him by the Farinas in possession; but it was eventually decided in favor of the Cologne firm.

In the German city itself, Farinas continued to multiply, until, in the early part of the present century, there were more than fifty concerns carrying on the perfumery business under the famous old name. Shrewd Germans made journeys to Italy, where the name is not uncommon, and hired some peasant Farina to return with them to Cologne, and become the nominal head of a firm in which he was allowed a small interest, sufficient to warrant the legal use of his name. In many cases the Italian was afterwards bought out, with the understanding that the business was to go on under the former title of the concern. It is said that Cologne babies of the masculine persuasion have been christened John Maria Farina, though the father might bear the name of Schmidt or something equally German, with a view to the infant's going into the promising *eau de Cologne* business in after-years.

We need hardly say that frequent lawsuits have resulted from these attempts to rob the original house of Farina of its hereditary honors and emoluments. Some years ago the number of these suits had run up above four hundred, and twenty-one were at that time in process of litigation.

It would appear, that soon after the invention of the perfume, about the year 1727, an "eau de Cologne" was made and sold in that city by a certain Paul Feminis of Italian birth; but the description of this preparation indicates that it was a quack medicine for internal use, and not a perfume. It was commended as a cure for "any disease or predisposition to the same," from apoplexy to toothache; but no mention whatever is made of its fragrance or its use for toilet purposes. The medicine and its originator seem to have been soon forgotten.

The manufacture of the renowned perfume has always been a "trade secret," most carefully guarded. It is said, that "at stated periods the proprietor retires to a certain strong room, where, in solemn solitude, surrounded by thousands of pounds' worth of precious oils,

he combines each of them as are required. This mixture is added to the spirit in great casks, and the liquid is always allowed a few months to mature before bottling." When the casks are emptied, a deposit of bluish mud is found in the bottom; and this is collected and given away. The poorer classes in Cologne are stated to have great faith in its virtues as an embrocation in rheumatic affections.

No doubt the "eau de Cologne" made in Paris and London and Boston, and other places, is often in no wise inferior to the original compound of the first John Maria Farina. The precise *bouquet* of this has been very closely imitated by some manufacturers, so that only an expert could distinguish the imitation from the genuine article; while other makers, who do not attempt to reproduce the "only veritable" fragrance, may fairly claim that their combination of exquisite odors is as good as the original, if not better. There is much, however, in a name, in spite of what Shakespeare says to the contrary; and for years to come, as in years past, there will doubtless be thousands of people to whom no "eau de Cologne" will *seem* to "smell as sweet" as that from the ancient shop "opposite the Julich's Platz" in the Prussian city.

SIMPLE SCIENTIFIC EXPERIMENTS.

IF a very fine cambric needle is carefully placed upon water, it will not sink, although much heavier than an equal mass of water. This is due to the fact that the bright surface of the metal is not *wet* by the water, which is repelled from it by capillary action, the same as the mercury in a barometer is repelled from the

FIG. 1.

sides of the glass tube. Thus a little depression is formed in the water, as shown in Fig. 2; and the total bulk of water displaced by the needle is equal to that which would fill the depression under the dotted line *CD*, which would more than equal the weight of the needle, which, therefore, remains on the surface.

It is, however, very difficult to place the needle on the water so gently that it will not sink; by the method shown in Fig. 1, however, not only cambric needles, but much larger ones, pieces of copper wire, new steel pens, and even a gold dollar, can be made to float.

A piece of blotting-paper is placed on the water, and the object carefully placed upon it. In a few minutes the paper will become saturated and sink, leaving the needle or other object on the top of the water. The experiment succeeds better if it is slightly greased by passing between the fingers or wiping with an oily rag, and a novel compass may be made by previously rubbing the needle with a magnet, when it will always turn to a north and south direction.

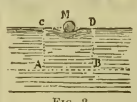


FIG. 2.

The third engraving shows an experiment upon the conductivity of metals. A piece of thin cotton cloth is wrapped around a gas-

FIG. 3.

burner, and held in place by a string or twisted wire. The gas is then turned on and lighted, and will continue to burn for some time without injuring the cloth; the metal of the burner conducting away the heat with such rapidity that the temperature cannot rise high enough to ignite it. A metal-tipped burner is essential to the success of this experiment. The lava tips in general use will not answer; and the cloth must be perfectly smooth, and in close contact with the metal, or it will take fire. It is hardly necessary to add, that, in view of possible accidents, the cloth used in the experiment should not be of any value.

The engravings are reproduced from *La Nature*.

[Original in *Popular Science News*.]

FIELD GEOLOGY.

BY PROFESSOR N. S. SHALER.

II.

Glacial Phenomena.

IN the previous article on this subject we considered the work of the beginner in geology in so far as his study should be directed to the surface phenomena of the earth. As geology considers the results arising from the application of the forces to the earth's surface, the student had best, in all cases, begin his studies by observing the effects which arise from rain, frost, and the action of the rivers and of the sea. In this way he accumulates information which will be of the greatest value to him when he comes to consider the history of those rocks which have been constructed in past times. Let us assume that the student has given a season to observation on the effect of the geological forces now working upon the surface which is open to his inspection. He will then be ready to go into the past, and to interpret the work accomplished by those agents in other geological periods than his own.

The first step into the past brings him into the division of geologic time immediately preceding the present period. The greater part of our readers will doubtless find themselves in the field which bears a record of the glacial period. Very nearly all of that part of North America lying to the north of the Potomac, the Ohio, and the Missouri Rivers, as well as some portions of the country to the south of those streams, is within the glaciated area. Even where a given territory lies altogether south of the region immediately affected by the ice-sheet, there are frequently effects referable to that action which deserve the attention of the student. The difficulty which he will find is, that his ordinary experiences about his home will not supply him with any facts which are likely to explain the mode of action of glaciers. Even if travel has made him familiar with glaciers as they exist in the mountain valleys of Switzerland and elsewhere, the monuments of ice-work which were left by the continental glacier will remain very puzzling to him, for the reason that the work done by such a vast covering of ice is, in many ways, different from that which is brought about by the relatively small glacier streams which remain in regions remote from the poles.

To get an idea of the conditions which prevailed in the glacial period, the student needs a long-continued exercise of the constructive imagination. He must slowly, through his own work and the labor of others, build up a picture of the conditions prevailing during the glacial period. This is a somewhat difficult task, and cannot be accomplished without great devotion to this particular branch of geology. Nevertheless, certain parts of the glacial work can be advantageously studied by the beginner. If he be careful, he can not only proceed to lay the foundations of one of the most magnificent conceptions to which the geologist can attain, — i.e., that of the vanished continental glacier, — but he can do good work which will be of value to other students in geology.

Almost everywhere in the field recently occupied by the ice-sheet, the surface of the bed-rock is scratched and grooved by the pebbles and sand held in the mass of the ice, and pushed forward with it over the bed-rocks. These scorings of the rock indicate to us the direction in which the ice moved in the time just before it passed away from the surface. The student should, at the outset, obtain the best existing map of the region in which lies his field-work. He should, if this map be very imperfect, correct it as best he may. On this map he should put down the exact course of these scratches. In mapping the scratches, he should, if possible, use a compass with a needle two inches long, and which reads continuously around from the north by the east, from the beginning to three hundred and sixty degrees. In practice, he should proceed as follows: Noticing at the outset that these scratches do not all trend in the same direction, he should select at least one scratch from each different set which he may be able to observe on the surface. Placing a straight stick in the exact

line of the scratch, in order to make the observation more exact, the direction of this indicator should be accurately observed. The student's note-book should set forth in a distinct way the measure of clearness with which the scratches are exhibited; and it will be well for him to make a little sketch, showing, on a page of his record, the way in which the several scratches stand related to each other. Where the scratches are at all plain, it is generally desirable to take the compass course of a dozen different groups. The place on the map where the observations are made should be indicated by a number corresponding to the number in the note-book. If the student will make observations of this nature on any surface a few square miles in area, his work, if carefully done, will have a distinct value in the records of glacial geology. Having accomplished this task, the observer should then assemble his observations in his mind's eye, as well as on a reduced sketch-map, so that he may conceive the variety of motion, almost always considerable, which marked the passage of the ice in its lower parts over the given surface. When this task is done, he has attained to the first conception, and one of the most important, conceruing the action of continental glaciers. If the surface he has in mind exhibits considerable differences of height, he should try to note the variations in the movement at different elevations. In case there is a considerable isolated hill in his field, he should observe the differences in direction which the movement exhibits. He will often find that the ice north of the hill was perceptibly turned aside where it came down upon the elevation of the scratches, diverging to the east and west at the north end of the hill, and again converging at its southern extremity. The observer should know that these glacial scratches are rarely found on rocks which have been long exposed to the action of water or of the atmosphere. He therefore must seek them on surfaces which have recently been uncovered; and in many cases he can profitably spend some of the large store of energy which he must put into his work, in baring surfaces with the spade which will afford him information. To make such studies of value, it is, in almost all cases, desirable that there be at least half a dozen observations at different points in each square mile of area. Still, a much more limited number of such observations may be useful, not only for his own purposes, but for those of other students.

The next inquiry to be taken up by the beginner in glaciology should have reference to the *débris* left upon the surface by the ice. A brief inspection will show the student that this *débris* is not uniformly distributed over the surface. In some places it is very thick; again it may be of considerable area, especially the hilltops, which have a thin coat of this waste; or it may be altogether absent. Next, he will observe that the surface of this waste varies very much in its character. Occasionally it is accumulated in heaped irregular hillocks, again in long, regular ridges, yet again in the form of plains. Taking advantage of the numerous openings which in all regions disclose something of the structure of the glacial deposits, he will quickly see that there is a relation between this structure and the form which the surface of the deposits assumes. In the irregular bowldery accumulations, he will find scarcely a trace of stratification; he will notice that the large angular stones, smaller pebbles, clay, and sands are confusedly huddled together. Especially remarkable is the position of the large fragments. They have their longest diameters at all angles to the horizon. The attitudes of the larger pebbles, as well as the mixture of sand and clay without stratification, make it clear to him that this mass, which geologists term till or bowlder clay, has been formed without the action of fluid water; for if the fragments of stone had ever been free to move, as they are in water, their attitudes would be very different from those in which we find them. The stones would commonly lie with their major axes nearly parallel to the horizon.

In the plains composed of glacial drift, the observer will always find the sand and pebbles arranged in more or less distinct layers, showing that the deposits were accumulated by moving water. We thus find in the drift deposits evidence of two distinct forms of work, — that done by ice, and that effected by water. A little consideration will show us that the detritus of the glacial period must represent the closing stages of the great ice-time. It is, therefore, not surprising to find in the same field evidences of water as well as of ice action; for, as the glacier was passing away, the streams which bore off the molten water were necessarily somewhat larger than at present, and had much more irregular courses than they now have. Moreover, it is clear that our continent was tilted downward to the north when the ice first went away, and so lakes were formed in the region immediately south of the ice-front, which disappeared when the continent came to its present attitude. For a long time after the ice went away the awakened streams were engaged in a combat with the difficulties which beset their paths, — difficulties arising from the irregular deposition of the drift. The student has a very interesting field before him if he will undertake to trace the history of the rivers and streamlets in a glaciated field since the ice disappeared from its surface.

After some preliminary study which has for its purpose to familiarize the eye with the varied aspects of the drift, the observer should undertake to classify the several forms of this *débris* which he has noticed. In general, he will find that in any area ten miles square there are four or five different aspects of the drift, the differences being indicated either in the external form of the masses or in their internal structure. The principal varieties in these types of drift are as follows: *first*, the tolerably continuous sheet of unstratified bowlder clay or till; *second*, local accumulations of this till-like matter which have been pushed forward at the ice-front; *third*, long serpentiform ridges, known commonly as kames; *fourth*, plains of tolerably level surfaces of stratified drift, which at some points pass into very irregular undulations; *fifth*, arched hills of very uniform outline, composed in most cases altogether of till-like drift, and known as lenticular hills, or drumlins. The first of these classes, the sheet-till, doubtless represents the pebbles and finer material which was entangled in the ice, and which, at the time when the ice melted away, was dropped upon the surface. The stratified drift was probably accumulated in temporary lakes, or beneath the surface of the sea which lay over a considerable part of the continent when the ice went away. The serpent-like ridges are more puzzling. They were probably formed in arches, excavated in the lower portion of the ice at its contact with the ground, by the considerable streams which we know to have flowed from beneath the glacier. In these arches the plentiful waste formed by the ice was packed and moulded to the shape of the cavity. The origin of the drumlins is not yet understood; and it is possible that the observer, by careful studies, may be able to throw some light upon their history.

After becoming familiar with the aspect of the drift, the student will do well to trace in his field the origin and distribution of the different kinds of rocks which compose the glacial *débris*. In many cases he will be able to follow trains of bowlders for a great distance from their point of origin. If, for instance, there is a peculiar rock which occupies a small area, he should endeavor to trace the bowlders which it has furnished, from their point of origin southwards in the direction of the ice-flow. In all cases he will find that this bowlder train gradually widens as it goes southwards, and that the fragments become smaller and more rounded the farther they are removed from the source of the supply. He will also find that they become confusedly intermingled with the *débris* torn from the bed-rocks in the region to the north and south of the point where the trail originates. In this way he will secure a clearer idea of glacial movement than he can from the study of scratches alone.

After having become familiar with the form of the glacier *débris*, the student will do well to turn again to the erosive action performed by the glacier upon the bed-rocks of the country. For this purpose, he had best select some field from which the glacial *débris* has been in good part removed. By preference, he should choose some surface of varied hardness, such as he will find almost everywhere within the field of glacial action, except where stratified rocks lie in perfectly horizontal attitudes; he will find that the surface is worn in an extremely irregular way. All over it there are pits or depressions in the form of irregular warpings of the surface. If a considerable area of rock is entirely cleared of the *débris* which originally covered it, these pits become, after every rain, shallow pools, in which the water remains until it evaporates. If such surfaces have long been exposed, they commonly become covered with vegetation, and each of these pools becomes a little swamp. Such a surface should be compared, if possible, with that produced by the action of unfrozen water. Where water acts in its liquid form, it tends to create a perfect drainage: all the slopes lead continuously downward from the highest parts of the land to the sea. It is a peculiarity of glacially worn surfaces, that they have no such continuous inclinations from the highlands to the ocean level. The cause of this undulated or warped surface is simple. We find, on all the rocks which have been glacially eroded, the ice does the wearing by means of the bits of stone which are held in its mass, and pushed over its surface. Where the surface is hard, the wear may be slight; where it is soft, it is more rapidly cut away: the result is, that the erosion may be extremely irregular. Deep pits with intervening ridges may be formed; and, when the ice disappears from the region, it may be a long time before the streams fill up these depressions, or wear away the barriers between them, and so bring the surface to the form which running water tends to give it.

In almost all glaciated countries we find that the streams operating since the close of the ice period have, in part, filled these depressions with sand, gravel, or mud. The swamp plants have converted many of them into the form of pit-bogs.

In New England, for instance, by far the greater part of the original lakes left at the close of the glacial period have thus been obliterated; yet there remain many thousand basins containing water, to mark the peculiar action of glacial ice upon the surface of the country. Besides the true rock basins, a great number of lakes are formed by irregularities in the shape of the detrital deposits left on the surface at the close of the glacial period. Where these basins are large, and the streams which pour from them are strong, they generally cut down their channels to the level of the bed-rock.

We have already indicated to the student the most important lines of inquiry which he can follow in tracing the history of glaciation in almost any

district within the field of the old ice action. There are many other inquiries which can only be pursued in districts which are peculiarly fitted for particular research, and which therefore cannot be discussed in this general essay. The main aim of the student should be, to make use of the peculiar facts connected with glaciation, in order to enlarge his scientific imagination. The great risk is, that he will be led to speculations which he cannot criticise by the facts before him. To escape this danger, he needs remark the fact, that in all scientific inquiries there are three stages in the process of exploration, — first, he must gather the facts, securing them by close inspection and by careful noting. His notes should, as far as possible, take the graphic form; they should, at least, be diagrams, and, if possible, pictures, however inartistic, still showing, at least to his own eye, what is the actual shape of the fact. Next, he must exercise his imagination to conceive what were the circumstances which brought about the conditions which he seeks to explain. Lastly, he must revisit his ground, in order carefully to verify the sufficiency of the explanation. This last process is the one most frequently neglected by observers. On the patience and honesty of the criticism which the student applies to his observations depends the scientific character of his work. It is necessary to use the imagination in the construction of hypotheses, for without them no advance is made in the interpretation of phenomena. But until the critical work above noted is well effected, the student has not brought his studies to the point where they have any scientific value whatsoever. All the advance of modern science has been due to a better understanding of the value which pertains to this latter part of an investigation, — the verification of the hypothesis.

(To be continued.)

NATURAL HISTORY NOTES.

BY DR. S. F. LANDREY.

VI.

ACCORDING to personal experience, the various kinds of peppers have a value, each of its own, with which mankind cannot dispense. The varieties used in ordinary "pepper-sauce" are certainly the most useful when used in food. Aside from constitutional idiosyncrasies and certain inflammatory conditions of the digestive organs, peppers may be freely used at times to the benefit of both body and brain. Three to eight peppers, from the common sauce of the tables, finely divided and mingled with potatoes (mashed), on meat or on eggs, will certainly, in atonic dyspepsia, produce an aperient, and often a severely cathartic effect. I have many a time produced an appetite for food, when my stomach loathed the very sight of it on sitting down to eat, by merely eating a few peppers, or by the use of the sauce on beans, potatoes, or meat It is an excellent stimulant in cold weather, and in feeble bodies better than any of the alcoholic poisons.

It is *always* best to use the vinegar off, and refill once or twice before venturing on the use of the peppers themselves; otherwise, one may be reminded of the two Indians who dined in Washington City a few years ago. The young buck had eaten some of the peppers themselves. Tears found their way down his cheeks. Says the old chief, "What are you crying about?" — "Oh!" said he, "I was thinking of my dead father." The chief took some on his plate, and ate. The young man, perceiving he, too, was in tears, asked the chief why he cried? He answered: "I was only weeping because you, young rascal, did not die when your father did." The strong tincture applied around the edges of the feet and on the soles with a feather, but not between the toes, nor where the skin is broken, is the best foot-warmer in the world. Apply twice daily till benefited. The oil is too strong to use without proper advice; it is dangerous in the eyes or mouth.

THERE are mimicries of color, form, and action, intended ostensibly for the self-preservation and protection of animals from their enemies. When about eight years old I first realized what mimicry in birds meant. Below the double log-cabin, on the brow of a hill flanked on the east by a deep, rocky water-wash, from the turnpike culvert, stood an old ash-tree with a broken-off top. About six feet above the top of the rail fence beside it was a large projecting limb; in the fork a pair of turtle-doves had built their nest. Like all boys who are watching every thing around them, I discovered them carrying materials to build. This process was watched at a safe distance till the work was completed. A few days afterwards, finding the nest empty of birds, I climbed up, and beheld two beautiful eggs. Finally these were hatched, and my visit to the nest became too frequent for the mother's considerations of safety. Thinking she was out after food one day, as she could not be seen on the nest, I cautiously climbed up close enough to touch the nest, when all of a sudden down tumbled the mother-bird, and seemed to strike hard on the ground. I dropped down quickly, thinking she was hurt, to pick her up. She fluttered, rolled over, spread her wings, bounded up and down, and started off, uttering many short, mournful sounds, as if in great pain and distress. I clambered over the piles of rock, ran as best I could after her till she reached the turnpike, a dozen yards or more up-hill from the tree. Here, as I quickened my pace, I tried to throw my hat over her, or grasp her; she became more and more agile, and fluttered away from me faster and faster. The chase kept up through the adjoining field, till near the timber on the opposite side, when she rose and flew above the tree-tops, perfectly free from all lameness and wounds. I watched her with a disappointed, foolish feeling, occasionally laughing at the trick, till I saw her make about a half-mile circuit, and return to her nest. I had learned that even the symbol of innocence could tell an untruth.

Long years after this incident a mother-quail tried to lure me from her nest in a hay-field in a similar manner to that of the dove. My father used to say, "If a man deceives you once, it is his fault; if twice, it is your own fault." So I left Mrs. Bob-White to play her little game of deceptive mimicry in her own way, left her nest undisturbed, and before I had gone far had the satisfaction of seeing her return to her brood of half-hatched quails. An old wild duck tried the same trick on another occasion. She had ventured to land on the creek-bank with a handsome brood of ducklings; I gave chase, and she pretended to be very badly crippled. I did not follow, but picked up a couple of the ducklings, and walked off; she followed quite a distance in the water, trying to get me to drop them and follow her; but I had been to school, barking my shins after the dove. Her mimickry was all in vain.

Two large crayfish were placed in a gallon glass jar of water, used as a temporary aquarium. They were both large, full-grown specimens from the creek, and were cramped for room. They whisked their antennæ a few times, eyed each other fiercely, and almost immediately commenced shearing each other with their great chelæ, or claws. In a few minutes one of them had lost two chelate legs, while his antagonist mourned the loss of one of the chelæ. They fought and rested at intervals during the day. Next morning the one which had lost his shears was found dead with a crushed tergum, or broken back. The carapace was split open; cannibal-like, his mate had partially eaten him, and was "monarch of all he surveyed." The swamp crayfish, or chimney-builder, will fight desperately if teased by touching his antennæ. They will even spring up from the ground two or three inches to catch the teasing fingers.

[Original in *Science News.*]

NIAGARA IN WINTER.

BY H. J. SEYMOUR.

THERE are some phenomena that can be seen at the Falls in winter and spring that are essentially different from what we observe in ordinary rivers. For instance, high and low water are not so immediately dependent on rainy or dry weather as in the case of ordinary streams. This results from the river being the outlet of such large lakes. Variations in the volume of its waters are more immediately dependent on the force and direction of the wind on Lake Erie than on any other cause. A strong westerly wind piling the waters at the east end of the lake makes high water in the river, while a strong easterly wind causes low water.

Another peculiarity of Niagara is the fact that its waters are seldom frozen over at the Falls and Rapids. The constant and powerful agitation of its waters is the cause of this. Not that there is an actual absence of ice, but it takes the form of anchor-ice, — a viscous substance that sticks to every solid thing with which it comes in contact, making no end of trouble to those who would use the waters for manufacturing purposes.

One result of this continual exposure of the comparatively warmer waters to the atmosphere is a somewhat warmer climate in winter immediately around the Falls and Rapids. The thermometer never indicates as low temperature in their vicinity as at a moderate distance eastward, making a climate favorable to the raising of peaches and other tender vegetation.

Another interesting phenomenon is the deposit of ice from the spray on the rocks, land, and trees near by. The ice attains the dimensions of a hill nearly a hundred feet high, near Goat Island, on the American side, where the waters dash upon the rocks at the foot of the Falls, and doubtless enough of continuous cold weather would cause the ice to hide them from view.

But what is to me the crowning feature of interest at the time of the approach of warm weather is the immense quantity of heavy ice that floats through the Rapids and over the brink, and dashes into innumerable fragments on the rocks below. The amount that Lake Erie can furnish that is two feet or more thick, is not easily calculated. The cakes are sometimes two rods across. As they float into the Rapids, they move faster and faster, but with the most imperturbable steadiness, gravity, and dignity, that seems to rebuke the unseemly levity of the curling waters around them. But this dignity cannot long be maintained; for presently, being drawn into the more shallow and violent Rapids, they are dashed down declivities of three or four feet, amid the foaming waters, and, striking the bottom with a heavy thump, are broken into many fragments. By the time they reach Goat-island bridge, they are seldom more than five feet across. Sometimes, striking the sharp, iron-pointed pier, they jar the whole structure. The heavy, audible thumps that the bottom gets from them, where the water is shallow, suggests a more powerful agency in wearing and breaking away rock than that of water in its fluid state.

But it is when standing at the foot of the stairs, near the brink of the Bridal Veil on Goat Island, at the time of the descent of the ice, that we witness the climax of sublimity and beauty. In regard to sound, we have the steady and eternal roar of the falling waters, which we may call the solo. But now it has a drum accompaniment. As the heavy pieces of ice, often slightly hesitating at the shallow verge, balance over, and make the awful plunge, we presently hear the deep-toned crash of their utter destruction on the rocks below, the sound being modified into the deep tones of the bass-drum by the falling waters and the rising spray.

Then, again, there are objects to awe and charm the sense of sight. There is the mountain of ice rising from the foot of the cataract; the long line of waters pouring over the jagged edge; the cloud of white spray rising before you, with a nearly perpendicular column of vividly colored rainbow painted on it, that is refracted from the sun, which is in the west, behind you; and in the background the light and graceful tracery of the new suspension bridge. Surely here is a combination of the wonderful, grand, and beautiful that can hardly find its equal elsewhere on the continent.

SCIENTIFIC BREVITIES.

An Ancient Meteor. — A large piece of meteoric iron has been found in a bed of tertiary lignite, Upper Austria. This is the first find of that sort in distinct geological periods, — a proof that meteoric stones fell also in former periods of the earth's existence.

Flow of Streams. — An inclination of one inch in fifteen miles is sufficient to give motion to water. An inclination of three inches per mile in a straight, smooth channel will give a velocity of three miles per hour, while three feet per mile would produce a torrent.

Electric Carbons. — Of 150,000 carbons burned daily in the electric lights used in the United States, 100,000 are manufactured in Cleveland, O. Six years ago all the carbons burned in this country were made in a single room in Boston. Now there are twenty carbon furnaces in Cleveland alone. The carbons are made chiefly of the residuum of oil after it has been refined, but the deposit about natural gas-wells is also coming into use. The material is ground to a powder, a little pitch is added, and the substance is then placed in moulds. These are packed in boxes, and the latter placed in a furnace, where they are subjected to the most intense heat. The capacity of an ordinary furnace is 45,000 carbons.

Ozone. — Messrs. J. J. Thomson and Threlfall have determined that ozone is not produced when dry oxygen is placed in an electric field, not even when a spark is allowed to pass. The gas was carefully dried and purified before entering the chamber, and was tested at the outlet by a sensitive solution of iodide of potassium and starch. The same investigators have made some curious observations on the effect of passing electric sparks through nitrogen contained in a tube at a pressure less than 0.8 inch. of mercury. A very slow, permanent diminution of the volume of the nitrogen occurs, which, at a pressure of only 0.3 inch, may amount to as much as eight to twelve per cent of the original volume. If the tube be then heated to 100° C. for several hours, the original volume is regained. It would seem as though some modification of nitrogen were formed, bearing to ordinary nitrogen a similar relation to that which ozone bears to oxygen. The existence of such an allotropic form of nitrogen has long been urged by Mr. G. S. Johnson.

Practical Chemistry and the Arts.

A WATER-PUMP FOR THE LABORATORY.

A useful piece of laboratory apparatus is figured in *La Nature*, by which either a vacuum or a blast of air may be obtained by the force of a stream of water from the ordinary service-pipes. It is claimed to have been invented by a Mr. Lane in 1872, and was used in the laboratory of the Massachusetts Institute of Technology as early as 1875 at least, when we had one made from the same pattern, which did good service for several years.

The instrument, which operates on the well-known principle of the steam-boiler injector, is preferably made of brass, and is attached by a rubber tube or metallic screw-joint to a water-tap. The construction is clearly shown in Figs. 2 and 2′. The stream of water, rushing through the contracted passage *AB*, produces a vacuum in the tube *T*, which can be

Fig. 2.

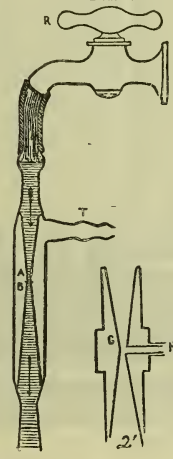
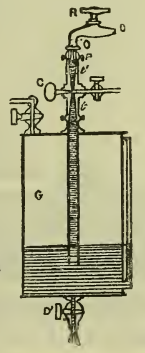


Fig. 3.



connected with a filtering flask, or any other apparatus desired.

Fig. 3 shows the same apparatus with an attachment for producing a blast of air. The outlet tube of the injector is continued nearly to the bottom of a cylindrical-vessel, *G*. The air, drawn by the force of the current through the tube *T* (Fig. 2), passes into the vessel *G* mixed with the water, where it separates; the water passing off through the lower cock (*D′*), while the air passes off through the one at the top. If the lower cock be nearly closed, a certain quantity of water will accumulate in the cylinder, and compress the air therein, and the latter will escape under pressure through the upper one. It is said that a pressure equal to four inches of mercury can be obtained.

A simpler arrangement to produce a current of compressed air, which has worked well with us, is to substitute for the cylinder *G* a cylinder of glass, open at the bottom, and easily made by cutting off the bottom of a tall glass bottle. The two tubes are passed through a rubber cork tightly inserted in its mouth. The bottle is placed in a jar of equal height; or a common water-pail may be substituted, and the injector connected with the water-faucet, as shown in the cut. In this case the mixed air and water separate in the bottle, and the water flows away over the edge of the jar or pail, while the air passes off through the tube in the rubber cork, under a pressure of a column of water of a height equal to that of the bottle or cylinder into which the mixture of air and water is forced. We have had no difficulty in operating an ordinary blast-lamp with a pressure of only five or six inches of water; but, of course, greater pressures can easily be obtained.

This apparatus is much cheaper and easier to manage than the old form of Bunsen's filter-pump, and for all the ordinary operations of the laboratory is equally effective. It will doubtless come into very general use.

A CURIOUS EXPLOSION.

BY PROFESSOR C. A. YOUNG.

A few weeks ago we had a curious explosion here, which is, I think, worthy of record, in order that similar occurrences may be guarded against in future. What exploded was a steel cylinder which was being charged with oxygen gas in the basement of the School of Science building. It was one of the so-called forty-foot cylinders made by the New York Calcium Light Company, and was intended to be charged to a pressure of fifteen atmospheres; it had been regularly used at that pressure for a year or two. At the time of the explosion the pressure was only about ninety pounds, as shown by a pressure-gauge connected with the apparatus. This gauge had been duly tested only a week or two before, and found correct. The oxygen was being pumped into the cylinder from the gasometer by an ordinary force-pump, furnished for the purpose by the makers of the cylinder, and driven by steam-power at the rate of about eighty strokes per minute. The lower portion of the cylinder was immersed in a vessel of water, to keep it cool; and the pump piston was lubricated with a heavy mineral oil, such as we are accustomed to use in the steam-engine cylinder. The seat of the lower valve is of hard rubber, and had just been faced off, so that the pump was in exceptionally good order, and working very effectively. The connection between the pump and cylinder was by a heavy lead pipe of about a quarter-inch bore, and about five feet long. At the time of the explosion two persons were in attendance, — one of them Mr. Fisher, the mechanician of the School of Science, in charge of the machine-shop, who stood by the pump watching the pressure-gauge; and the other his assistant, who was standing by the cylinder itself. Suddenly a flame, blue or green, and some three or four inches long, made its appearance on the top of the cylinder, where the lead pipe was coupled to the stop-cock. The young man at once reached out with his hand to turn the wrench (which was in its place, on the top of the cylinder), in order to prevent any loss of gas: at the same time

naturally turning half round away from the cylinder, stooping a little. Before he could turn the wrench, the thing exploded, with the noise of a six-pounder gun; the cylinder tore in two about six inches from the bottom. The upper part flew up, striking the floor of the mineralogical cabinet above, giving such a blow as moved some of the cases several inches, and shook the specimens completely into *pi*. The glass of every window in the basement was blown out, the plastering was knocked down, and the whole establishment was pretty thoroughly wrecked. Strange to say, neither of the men was much hurt. Mr. Fisher had his eyebrows singed, and a piece of the cylinder, nearly as large as one's hand, was shot through the brim of his hat, passing within an inch of his forehead. The assistant was sent flying, head first, nearly twenty feet, against the gasometer tank. Of course, he was a good deal bruised and shaken, but fortunately not seriously injured, — not enough to confine him to his room even for a single day.

Somewhat similar explosions, but much less violent, had occurred two or three times before, always in charging the *oxygen* cylinder; but the damage done had never been any thing more than blowing off the lead tube from its connections, or bursting it. I learn also that something of the same sort is not quite unknown in the pumping-rooms of the establishments which deal with the gases on a large scale.

Now, as to the explanation. My theory is this, and several eminent chemists and physicists to whom it has been proposed accept it, while none, so far as I know, reject it. The explosion was probably due to the *firing of oil-spray, and possibly a little oil-vapor* mixed with the oxygen gas. The inside of the cylinder, after the explosion, was found to be covered by a film of oil, which undoubtedly came from the pump cylinder, and was forced into the pipe along with the gas; a little puff of gas and oil-spray passing through the valve at each stroke of the piston. Now, oil in pure oxygen will, of course, burn with extreme violence and the evolution of great heat, if any thing sets it on fire; and though the immediate effect of such firing might not be an explosion quite in the sense of an explosion of gunpowder or dynamite, yet it is certain that the sudden and intense heating of the gas in the cylinder would immediately raise the pressure, already ninety pounds by the gauge, to three hundred or four hundred pounds, and quite beyond the strength of the metal. The fact that the young man was not torn to pieces, but simply pushed and thrown, corresponds to an explosion of the kind indicated. At the same time, the fact that the hand with which he tried to turn the wrench was slightly singed, shows that *fire* was present: it was not merely a case of a cylinder weakened by age and rust, bursting under a pressure it ought to be able to bear.

The firing of the mixture of oil and gas was unquestionably due to the sudden pressure produced at the lower valve of the pump by each piston stroke. It will be remembered that the seat of this valve was of vulcanite, a very poor conductor of heat; so that, although the bottom of the cylinder was kept fairly cool by the vessel of water in which it was immersed, yet there was nothing to prevent the gas itself, just at the valve, from becoming very hot, and even rising above the temperature of ignition, if at any time, during a stroke or two, the valve happened to stick a little.

The moral is simply this: Do not lubricate an oxygen pump with *oil*, but with *soap-suds* or something that will not burn in oxygen.

PRINCETON, N.J., *April*, 1887.

FIG. 1.

PHOTOGRAPH OF A MIRAGE.

THE above illustration (Fig. 1) is a copy of a photograph of a mirage observed at Madras. It was published in the London *Graphic* and is the first instance in which the phenomenon has been caught and preserved by the camera.

Similar mirages are not uncommon along our own coast on calm, hot days in summer, when, owing to the different refractive power of the unequally heated strata of air, images of vessels on the water, or the coast-line itself, are distorted in every possible way, and apparently thrown up into the air, like the boat in the engraving. The images also frequently appear reversed, the masts of a spectral vessel touching those of the real one. Similar phenomena have also been observed over the land, but less commonly, owing to the irregularity of the surface, being unfavorable to the formation of quiescent strata of air of unequal densities. Over level plains and deserts, however, the conditions are similar to those of the ocean; and the deceptive mirage, mocking the thirsty traveller with its tempting lakes of water which vanish upon his approach, has become an almost classical allusion among writers.

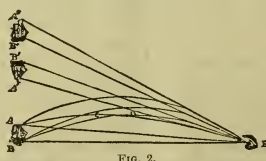


FIG. 2.

The cut (Fig. 2), from Rolfe and Gillet's *Natural Philosophy*, explains clearly the formation of the spectral image. A part of the rays of light, *CD*, proceeding from the vessel, *AB*, are so curved by passing through the different strata of air, that they enter the eye, *E*, in a direction which is apparently that of *A′B′* and *A″B″*. The eye, being unable to realize that it is "looking round the corner," naturally refers the position of the images to a point above the real object.

It is not often that so perfect a mirage as the one illustrated occurs, and its successful reproduction by photography adds another to the many uses to which the art has been applied.

A CONVENIENT SUBSTITUTE FOR SEALED TUBES FOR HEATING UNDER PRESSURE.

THIS device arose from a special difficulty in the heating of ether under pressure. A hundred and fifty cubic centimeters of ether, with an equal volume of an aqueous solution, were heated to 100° in a soda-water bottle, closed with a dense cork wired down. On cooling, the cork was found unmoved; but nothing was to be seen in the bottle, though it was mouth downwards, under water. The ether had so attacked the cork, though the aqueous solution was between, that crystals of salt from the solution were found in the body of the cork, which had also shrunk, but not enough to admit water on cooling; so that the bottle finally contained ether vapor and air only.

A soda-water bottle with ball stopper was tried,

with mercury to prevent the ether attacking the caoutchouc ring against which the ball presses to close the bottle. The difficulty was to close the bottle so filled, seeing that ordinarily, when the bottle closed by the thumb is inverted, the glass ball floats on the mercury. The bottle closed by the thumb was gradually inclined till the ball just rolled into its place, when the bottle was promptly inverted, and the thumb at the same time removed. In this way, after a few trials, closure may be effected every time, with the escape of only a few drops of liquid and not a drop of mercury. The bottle, still inverted, and having an inch or two of mercury in the neck, was boiled, and found in repeated experiments to stand the pressure of the ether perfectly. Moreover, the necessity of corking and wiring is avoided.

To prevent negative pressure, and consequent displacement of the ball, the bottle should be kept warm until it is to be opened. — *Chemical News.*

A BOMB TEST.

A Washington despatch says: "The inventor of a new kind of bomb, for which a patent is pending, came to see the Commissioner, who happened to be out. He brought with him a specimen bomb, which was enclosed in a pasteboard case; and he showed it to the Commissioner's private secretary, Mr. Will Montgomery. The inventor said that it would go off as soon as it touched water, and this specimen would make a noise, when exploded, like a fire-cracker. The private secretary had some curiosity to see the bomb tested, and sent out and procured a pail of water. When the bomb was thrown into the water, the effect was startling. The water was forced up with violence to the ceiling, and fell in a shower pretty well all over the room; while the noise of the explosion was like the report of a cannon. As soon as the few spectators could wipe the water out of their eyes, they pronounced the test a great success." — *Scientific American.*

EASY CHEMICAL EXPERIMENTS.

The Humorous Egg. — In a quill, place a small quantity of quicksilver, and, having fastened it well in, insert the quill through the end of a newly boiled egg, which egg, being placed on the table, will dance about till cold.

Magic Ink. — Any writing or picture made with a solution of cobalt chloride is invisible until heated strongly for a few seconds, when the written characters or picture appear of a blue color. By simply breathing upon the paper, they again disappear from view, to reappear if again heated.

Vanishing Spoons are a source of amusement, and are made from this alloy: bismuth, 8 ounces; lead, 5 ounces; tin, 3 ounces. As soon as boiling tea is poured into the cup in which they are placed, the spoons disappear from view. The drawback about this experiment is, that the spoons *do not reappear.*

Vortex Smoke-Rings. — All the apparatus required to produce this effect is an empty cigar-box, one of the ends of which, being removed, is replaced by canvas tightly nailed round it. A circular hole about one inch in diameter is bored in the opposite end; inside the box is a saucer half filled with carbonate of ammonia, upon which sufficient hydrochloric acid is poured until a dense vapor of ammonia chloride fills the box, which, upon slight, rapid pressure upon the canvas end of the box, is ejected from the hole, and assumes beautiful circles of white smoke, which ascend, and retain their shape till dissipated. — *Chemist and Druggist.*

Home, Farm, and Garden.

CHEMISTRY OF THE COOKING-STOVE.

The fuel consumed in cooking-stoves is usually either wood, or soft or hard coal. The latter is nearly pure carbon, while the former two contain varying amounts of hydrogen and oxygen. But, as the principles of combustion are the same in each case, the most simple substance only need be considered.

Let us imagine, then, a piece of hard coal, or carbon, heated to a point where its molecules, or ultimate particles, can enter into chemical combination with those of the oxygen of the surrounding air. The solid carbon disappears; and a colorless gas, carbonic dioxide, or carbonic-acid gas, is formed, which escapes up the chimney. Every ounce of carbon burned requires about seventy-five gallons of air, and produces, in burning, fourteen gallons of carbonic-acid gas. Fortunately, this gas is inodorous and harmless, except that, when present in closed rooms or other confined places, it displaces the air, thus destroying life, from the absence of oxygen. If this gas had been a pungent caustic, like ammonia, special arrangements must have been devised to carry it high into the air, and any form of combustion in the open air, including lamps, candles, and gas-lights, would have been impossible.

From the immense amount of air required to sustain a fire, the philosophy of the usual arrangement of dampers in the stove will at once be perceived. The hot air in the chimney, being lighter than the cold outside air, rises, and the latter flows in to take its place. If we wish the fire to burn briskly, we open the damper in the lower part of the stove, underneath the fire, so that a continual stream of air may pass through the burning coal supplying the necessary amount of oxygen. If, on the contrary, we close the lower and open the upper dampers, the current of air flows over the top of the fire; and, as the supply of oxygen to the interior is insufficient, it burns slowly, and finally goes out.

The question might be asked, What is this heat produced by our kitchen fires? and to this the chemist can give but an unsatisfactory answer. Heat possesses neither weight nor volume: we only know it by its effects. The most commonly accepted theory is, that it is caused by the oscillation, or vibration, of the molecules of the substances emitting it. Thus, when we ignite a piece of coal, the molecules of oxygen in the air rush to unite with the molecules of carbon; and, to use a rough and imperfect illustration, as the cold piece of iron which the blacksmith hammers, becomes hot from the force of his blows, so, as the different molecules rush into chemical combination, the force of their collision causes the resulting molecules of carbonic dioxide to vibrate more rapidly, producing the phenomenon of a rise in temperature. This vibration is transmitted to all surrounding bodies, — the iron of the stove, the air, and the food which is being cooked. It must be remembered, however, that this is only a theory, and may in the future be superseded by a more satisfactory one.

In the combustion of fuel, like soft coal or wood, which contains hydrogen in addition to the carbon, the same reactions take place, only that the hydrogen combines with the oxygen of the air to form water. Represented by chemical symbols it is as follows: —

Hydrogen.		Oxygen.		Water.
H—H	+	O=O	=	2(H—O—H);

or, when carbon is burnt,

Carbon.		Oxygen.		Carbonic dioxide.
C	+	O=O	=	O=C=O.

These are among the simplest chemical reactions known; but it is only about a century ago that the French chemist Lavoisier showed combustion to be a process of oxidation, and overthrew the phlogiston theory, which had been held for so many years. These common reactions are typical of all chemical changes; and since they have been rightly understood, the science has rapidly advanced to its present position.

THE MYSTERIES OF PLANT-GROWTH.

IV.

When certain parts of vegetables are burned, and especially their seeds, they give rise to those sickening vapors which characterize the combustion of decomposed animal substances. If they be burned with the addition of mixed soda and lime, the well-known odor of ammonia will become perceptible, and thus establish beyond doubt the presence of nitrogenous matter.

One of the most interesting of the questions which still remain to be *satisfactorily* answered by agricultural science, is that referring to the form and origin of the nitrogen which penetrates into plant organisms; and I italicize the word "satisfactorily," because, though many teachers have sought to explain the problem, no theories have yet positively merited this qualification.

I do not, however, hesitate to affirm that the air of the atmosphere is the inexhaustible source whence plants, and through them animals, acquire the nitrogen which their tissues contain; for, although an immense area of our pasture-lands are innocent of manure, they yet furnish to the grazing cattle a remarkable quantity of nitrogenous matters, which we trace either in their economies or in their various excretions.

Again: the crops withdrawn from certain cultivated lands often contain a much larger proportion of nitrogen than was existing in the soil, or even in the manures employed before the period of sowing; and whence could this surplus be possibly derived, if not from the air?

Disposing, therefore, of this part of the difficulty by admitting the atmosphere to be the source whence all living things withdraw their nitrogen, we have now to examine the forms in which this nitrogen is clothed; many eminent authorities having held that it is assimilated by plants.

A. — *In the form of nitrates.*

B. — *In the form of ammonia salts.*

C. — *Through various nitrogenous organic matters, independent of the two foregoing.*

D. — *In its free state, directly from the air by the leaves.*

The advantages derived from the use of nitrates of soda and potash are very generally admitted; and the enormous and constantly increasing quantities annually consumed in agriculture, sufficiently demonstrate the benefit resulting to plant-life from their employment.

As the reactions which follow their use in different soils are of a complicated nature, many agronomists have asserted, that, previous to their absorption, they are transformed into ammoniacal salts; but my own experiments prove this to be a delusion, as do those of Boussingault, George Ville, Lawes and Gilbert, Atwater, and others.

Boussingault's first series of essays was made with plants sown in a soil deprived of its organic matter, and therefore incapable of reduction. The result proved beyond controversy *that the nitrogen of nitrates is directly assimilated*, the weight of the vegetable matter formed being proportional to the quantity of nitrate that had penetrated into the tissues.

The following figures will suffice to illustrate the experiment: —

	Weight of dried crop, the grain being taken as 1.	Vegetable matter elaborated.	Carbonic acid decomposed in 24 hours.	Carbon acquired by the plant in 80 days of vegetation.	Nitrogen acquired by the plant in 80 days of vegetation.
EXPERIMENT A. — Without manure .	3.60	0.285	2.450	0.114	0.0023
EXPERIMENT B. — Manured with phosphate, ashes, and nitrate of potash . . .	198.30	21.111	182.000	8.416	0.1666
EXPERIMENT C. — Manured with phosphate, ashes, and bicarbonate of potash	4.60	0.391	3.420	0.156	0.0027

It would be a matter of great difficulty to show any thing more conclusive than this, especially when I add that I have repeated the experiments, substituting, however, nitrate of soda for saltpetre, with the same results; assuring myself, by careful analysis, that the quantity of soda found in the ashes of the plants produced, exactly corresponded to the quantity of nitrogen they had absorbed.

If the majority of our chemists are agreed as to the part played by nitrates, the same unanimity by no means prevails in regard to the utility of the various ammoniacal salts; for, while some maintain that they really penetrate into the plants, and directly participate in the nutritive process, others declare that the solutions of ammonia commonly used not only furnish plants with no nitrogen, but act as positive poisons to their roots when employed in the proportion of one part of ammonia to a thousand parts of water.

Mr. Cloës is a champion of the latter theory, and has recorded, that, in all his experiments on submerged plants, the application of ammonia solutions of this strength has brought about death; and amongst many special cases, he particularizes one, where the mere addition of a few drops of liquid ammonia to the water caused the plant growing in it to die.

Now, as one of his former students, I am a stanch believer in the general correctness and extreme conscientiousness of this eminent chemist and author; but I must nevertheless point out, that the startling facts he vouches for are diametrically opposed to the general verdict of practical farmers, who recognize the efficacy of ammonia salts as manure, and to the splendid results more recently obtained from their use at Rothamstead, England, by Gilbert and Lawes.

It may, perhaps, be argued that in these cases the manure has always been ploughed into the soil, where nitrification is continuously going on, and would naturally at once take place: but it would be difficult to make me believe in an entire transformation; my own experiments having convinced me that even in calcined sand, different seeds, alternately manured with nitrates, sulphate of ammonia, phosphate of ammonia, and ammonium nitrate, produce plants of a weight more than quadrupling their own. I readily admit that by far the greatest satisfaction was obtained from the nitrates; but it is an absolute fact that in the ammoniacal compounds employed, and which gave such good results, no trace of nitrification was to be discovered.

In my opinion, there is no doubt that salts of ammonia contribute to the nutrition of plants; but I will confess, that, when the weight of nitrogen has been equal in the substances applied, I have invariably found that nitrates furnish the most abundant crops.

At the commencement of the century, scientists were of opinion that plants directly absorbed the soluble portions of stable-compost; but since we have discovered the complexity of its compounds, it has become somewhat difficult to believe in this theory, because of the ease with which such bodies would, when once in the soil, be transformed into nitrates and ammonia salts. Paul Thénard at one time suggested that insoluble fumates ploughed into the fields very soon became soluble perfumates, and in this state afforded the necessary nourishment to vegetation: but, by pushing his experiments a little farther, he was soon compelled to confess that these same perfumates were of a very unstable and transitory composition; that, under the oxidizing influence of the iron peroxide in the soil, they were transformed into nitrates; and that, consequently, their absorption as nitrogenous organic acids could not take place.

George Ville, the well-known French agronomist, has submitted all varieties of plants to the influence of different nitrogenous principles, with a view to ascertaining their mode of action by comparison. A choice of species having been made, he administered to each *an equal quantity of nitrogen* in the several forms of nitrates of soda and potash, urea, uric acid, urate of lime, sal-ammoniac, and ammonium oxalate. The results he obtained were of a very diversified and highly interesting nature, explainable in two ways: First, by supposing that with some plants the nitrogenous matters directly absorbed are more or less easy of digestion according to their state of combination; or, second, by recognizing that the whole of the compounds he employed are reduced by decomposition to some form as yet undiscovered, in which alone nitrogen can be assimilated.

Not the least remarkable feature in ammonia salts is, that while some of them have precisely the same action as ammonia gas, others appear to be utterly inert. Ville, for example, first described, and my own direct experiments have frequently confirmed, that whereas the use of methylamine and ethylamine in the form of muriates produce exactly the same effect as ammonia itself, and while urea gave better results than ammonia carbonate, — from which it only differs in composition in the water element, — ethyle-urea produces no effect at all!

I have thus far endeavored to briefly establish that nitrogen really penetrates into plant tissues in the various forms of nitrates, ammonia, and some peculiar organic combinations the exact nature of which we continue to ignore.

I have now to discuss what is perhaps the most important question in agricultural science. Can it be assimilated by vegetation — in its free state — directly from the air, and independently of the soil?

FRANCIS WYATT, PH.D.

NEW-YORK CITY, *May*, 1887.

BAKED BEANS.

DR. EPHRAIM CUTTER, in a recent article (*Medical Annals*) on the nutritive value of this favorite New-England dish, gives the following rules for preparing it in the genuine "down-East" style: —

"1st, Soak a quart of beans over night in two quarts of cold water.

"2d, In the morning turn off the water, add fresh water, and boil them till the membranes begin to separate; turn off the water.

"3d, Put the beans in a baking-pot, with half a pound of salt pork buried in the beans; add two tablespoonfuls of molasses, and cover the whole with water. Bake in a slow oven all day; a baker's oven is best. Watch the beans, and, if they become too dry, add more water. When thoroughly cooked, it will be known by the softness of the beans in the mouth between the teeth, by the taste, and by the microscope showing the starch-grains broken up and mixed in one homogeneous mass that will not polarize light with a selenite plate.

"4th, Take time to eat and chew thoroughly.

"5th, After eating, go out in the open air and walk or work. Do not go to church right after eating baked beans; they will stay in the stomach, and their indigestion will do much towards spoiling the enjoyment of the exercises there. Dyspepsia and religion do not go together well, but good digestion and holiness are twins. Holiness, health, whole and hale, come from the same root. A holy man is a healthy, whole man, with all the functions in good order and no dyspepsia. Dyspepsia is a physiological sin."

A SCIENTIFIC SCHOOLBOY.

WHEN a boy, attending Dummer Academy, which was five miles distant from my home, I was excused from attendance whenever the mercury in the thermometer stood at 10° below zero. I ascertained, that, by filling the tin receptacle with mingled salt and pounded ice, I could produce this desired frigidity: so, whenever I wanted to go skating or coasting (there was no tobogganing in those days), I used to slyly fill the basin of the thermometer with cracked ice and pounded salt, and invite my mother's attention to it. The good-hearted old lady would at once excuse my attendance at school, and the day was devoted to amusement. This was, I admit, deceitful; but it was a scientific way of evading a five-mile pony-ride to the academy, and back again. — BEN: PERLEY POORE, *in Boston Cultivator*.

HOUSEHOLD HINTS.

MILDEW. — Sulphide of potash has been tried for mildew on roses, chrysanthemums, and other greenhouse plants with success. A quarter of an ounce in a gallon of water, thrown on the affected foliage with a fine rose syringe, will destroy the fungus without injury to the plant.

KEEPING LEMONS. — Professor Remington states that a solution of table-salt about the density of sea-water will be found effectual for their preservation for five or six weeks at a time; before the juice is expressed, the lemons are well washed with water.

TO KEEP EGGS. — Slack one pound of good lime in about three-fourths of a pail of water (eight quarts), stir it thoroughly, and let it settle. Drain off the water and about a pint of the settlings into a four-gallon stone jar, and set in the cellar, or other cool, dark place. Put the clean, fresh eggs daily into this lime-water, taking care to drop them in carefully, so as not to crack them; cover, and they will keep good a year or more. They are liable to crack in boiling, unless you make a pin-hole in the large end.

The Popular Science News.

BOSTON, JUNE 1, 1887.

JAMES R. NICHOLS, M.D.
WILLIAM J. ROLFE, A.M. } . . . . . *Editors.*
AUSTIN P. NICHOLS, S.B.

Attention is called to the special premium offer described on the fifth advertising page. There is no definite number of subscribers to be secured; but the photographic equipment will be given to the person sending the largest number of new names, even if the list should be a very short one.

The annual meeting of the American Association for the Advancement of Science will be held in New York City for one week, commencing Aug. 10. The exceptional advantages which that city offers for such a gathering assures a large attendance and a session of exceptional interest.

Mr. George W. Rolfe, son of Mr. W. J. Rolfe, long connected with the *News*, has been elected a foreign member of the Berlin Chemical Society, in acknowledgment of work done in the chemical laboratory of Harvard College last year. A paper prepared by him, in connection with Professor C. L. Jackson, on "A New Method for the Quantitative Determination of Hydroxyl," has been published in Berlin, and also in the *Proceedings of the American Academy of Arts and Sciences*. Mr. Rolfe graduated at Harvard in 1885, and gained his A.M. there in 1886. He is now chemist of the Geneva Grape Sugar Company, at Geneva, Ill.

"Arsenic Complexion Wafers" have been extensively advertised recently, and have been found to actually contain a minute amount of arsenious acid. It hardly seems possible that any one would take the responsibility of placing upon the market for indiscriminate sale a preparation containing this highly dangerous poison, or that any persons would knowingly make use of it, even to improve their personal appearance. Arsenic is altogether too powerful a substance to be used as a popular cosmetic; and, we may add, the only effect it has upon the complexion is to produce an unwholesome, corpse-like pallor, which is any thing but beautiful.

The latest novelty in the medical world is the employment of enemata of sulphuretted hydrogen, and carbonic dioxide gases, as a cure for consumption. Many prominent physicians have testified to the immediate improvement of consumptive patients under the treatment. There seems to be no philosophical basis for this very peculiar and roundabout method of treating an affection of the lungs, and the strongest point in its favor is the high standing of the physicians who claim to have used it with success. While we can only hope that the new remedy may fulfil the most sanguine expectations as to its efficacy, we should prefer to wait for a more extended trial before accepting it as the long-desired specific for the dreaded disease.

Another notable earthquake must be recorded. This time it is the territory of Arizona and adjacent parts of Mexico which has suffered, a region supposed to be exempt from such occurrences. The reports of volcanic outbreaks in connection with the shock have not at the time of writing been fully confirmed, and may have been due to the imagination of the excited inhabitants. An active volcano in our western mountains would certainly be an additional attraction to tourists, and "volcano excursions" may yet be as common in this country as in Italy.

THE POSSIBILITIES OF THE FUTURE.

A writer in a recent number of the *Open Court* attempts to predict the future condition of mankind judged by the recent progress in scientific and mechanical knowledge. According to this article, a most remarkable state of affairs will prevail in the next century, even if, as the writer claims, the predictions are confined "strictly to legitimate deductions from present knowledge." The whole article is a proof of the danger of "a little knowledge," and contains so many scientific errors, that their refutation may be of interest, especially as similar ideas are held by a large number of persons not having any knowledge of the limitations of science by natural laws.

The first improvement predicted is the general adoption of submarine navigation, based upon the recent experiments in New York harbor with a submarine torpedo-boat. He says: —

> Of the changes in commerce and naval warfare sure to follow the practical success of submarine navigation, there is room for abundant speculation. But we may be reasonably certain that Jules Verne's imaginary *Twelve Thousand Leagues under the Sea* will have its wonders surpassed by the stubborn facts of one hundred years hence.
>
> The fact that a boat may be constructed which can be guided under the water for a short time, does not indicate to the mind of a practical engineer the possibility of any extended application of the principles involved; and it is not too much to say that the difficulties in the way of general submarine navigation are insurmountable. We opine that many times one hundred years will pass by before Verne's entertaining romance is realized in actual practice.
>
> The fascinating subject of aerial navigation is also considered as an almost accomplished fact. The time for the production of a practical machine is limited to the present generation. Here again *we* may venture to predict that the problem of a successful flying machine will never be solved. We believe that the obstacles to the navigation of the air cannot be overcome; and not a single invention has as yet been brought forward which indicates that a beginning, even, has been made.

The writer of the article under discussion also speaks of the "electroscope" as "that remarkable instrument which virtually telegraphs rays of light, and, by throwing them upon a metallic disk, enables us to look upon actions taking place at a distance with the same ease and distinctness with which we now receive sounds by the telephone. Some combination of these two instruments will enable us in the future not only to talk with distant friends, but to look at them while we are talking; and that which is possible to-day within a distance of fifty miles, becomes possible on the morrow across the Atlantic Ocean."

It is only necessary to remark that he has been the victim of a clever newspaper hoax. No such instrument has ever been invented, or is likely to be. The connection of electricity with light is so different from that with sound, that it is not probable that any such rival or coadjutor of the telephone as is described will ever come into existence.

"That all railways, including those of city streets, will soon be run by electricity," the writer regards as "a self-evident proposition." This view is also held by many others; but, although it may be to them a self-evident proposition, it is a matter of mathematical demonstration that no ordinary railroad can ever be run by electricity except at an enormous cost as compared with present methods. As a substitute for horses in crowded city streets, electric motors may serve a very good purpose; but their application is quite limited, even in this direction.

One of the most amusing of the writer's "possibilities" is what is called "the terrible fact" of the storage of electricity. His words on this point are worth quoting in full: —

> The discovery of our ability to store or box electricity is a terrible fact, when we consider its possible consequences. As yet only a few are masters of the secret; but it will become a common property, and is susceptible of astounding modifications. To-morrow any man, good or bad, may have in his pocket, or in his pipe, power enough, and subject only to his will, to annihilate whole communities. That the ordinary man of the world will be forced to assume this awful responsibility, it seems to me no one can doubt. Will he, before that time comes, cease to be the same man with whom we are now most intimately acquainted? Give to our present biped acquaintance the ability to exterminate armies with a lightning flash, added to the power of sailing at will through the air, or of passing at will and in safety beneath the ocean waves, and he would depopulate the earth.

As every reader of the *Science News* knows, this is simply nonsense. "Boxed electricity" is one of the most harmless and inoffensive agents known to us. "Any man" can carry in his pocket a revolver which is capable of doing more harm than all the electricity that ever has or ever will be "stored." The secondary battery is not a destroying demon, but a helpful, though rather stupid and expensive, servant, ready to come to our assistance in certain emergencies, but not by any means to be feared.

Many other predictions are made, but we can only glance at them. Coal is to be superseded,

as a source of mechanical power, by the heat of the sun and the force of the tides! All our food is to be manufactured in a concentrated form in laboratories of organic chemistry. Disease will be abolished, and life greatly prolonged, by discoveries in medicine. In fact, in this unique article there is hardly a single prediction of future possibilities which is not either scientifically absurd or practically impossible. The scientific statements of the daily press are not supposed to be very reliable, but it would seem as if contributors to a journal of as high a character as the *Open Court* would at least inform themselves in regard to the elementary principles of science before attempting to enlighten their fellow-beings in regard to its possible achievements in the future.

POPULAR SCIENTIFIC SUPERSTITIONS.

THERE are many things generally believed to be true by those not especially conversant in scientific matters, which really have not the slightest basis of fact to rest upon. We have often been asked, for instance, if an ordinary microscope would show the millions of animalculæ with which every drop of water is supposed to swarm. This belief rests upon a very common misapprehension. Ordinary pond-water contains a few small animals, which, when magnified, certainly look rather frightful: but they are perfectly harmless, and not very numerous; at least, they do not swarm in every drop. Rain, spring, and other pure waters are absolutely free from all forms of life, except those accidentally introduced. By proper treatment, water containing impurities may be made to develop large numbers of bacteria; but they are not a regular accompaniment of ordinary waters.

It is also a matter of general belief, that, by certain chemical processes, water can be made to burn. Now, combustion, in almost every instance, is a process of combination with oxygen, and water is a completely oxidized body; that is, all the affinities of the hydrogen have been combined with an equal number of those of oxygen. The chemical reaction which would be accompanied with heat and light has already taken place, and cannot be repeated. It is true that we can decompose water into its constituent gases, and produce the phenomenon of combustion by re-combining them; but it is not the water which is burned in such a case, but the hydrogen gas obtained from it. The man who "was born to set the river on fire" must be classed with other mythical personages.

Another error concerning water has arisen from a remark imputed to Faraday, that "in every drop of water is stored up the energy of a stroke of lightning," which has been largely used by Keeley motor and other speculators to further their schemes. There is no force of any kind "stored up" in water; and the statement made by Faraday, if he ever did make it, simply referred to the small *quantity* of electricity developed in a lightning-flash, which would hardly be enough to decompose into its constituent gases a single drop of water. The powerful effects of lightning are due to the great *tension* of the electricity, like a very small boiler in which the steam is at an enormous pressure.

The existence in former times of malleable glass, which could be beaten into shape like metal, and was unbreakable, is often spoken of; but there is no scientific ground for such a belief. Glass is, from its nature, a brittle substance, and it is impossible to remove that quality from it. The "ever-burning lamps," reported to have been found alight in ancient tombs, may also be set down as existing only in the imagination. A perpetual lamp is as much an impossibility as a perpetual motion.

There is a widespread belief that carbonic-acid gas is especially valuable as a fire-extinguisher, and many machines are in use which are claimed to owe their effectiveness to the use of this gas. It is true that it will extinguish fire by displacing the air surrounding the burning material, but water is much better for the purpose; and the only use of the gas in the portable "extinguishers" is to force by its pressure the stream of water upon the fire. Under the conditions of an ordinary fire, the carbonic acid is of no use whatever to subdue the flames. The water does all the work, and is the best substance known for such a purpose.

The erroneous notions so commonly held concerning electricity have often been referred to in these columns; but we may again notice the belief that there is such a thing as "human electricity," or that the vital processes are in any way connected with this force. There have been no facts observed to indicate that such is the case; and the mysterious "vital force" is certainly not electricity, whatever else it may be. Electricity, when used for medical purposes, appears to act as a stimulant and tonic to the nerves; but its effect is probably due more to mechanical irritation than to any absolute life-giving properties possessed by it.

The faith that some people have in the barometer as a weather-prophet, is almost amusing. The barometer is a measurer of the atmospheric pressure, as the thermometer is of the atmospheric temperature, but is not an absolute indicator of the weather. It is found, as a general rule, that fair and clear weather is accompanied or preceded by a high, and storms by a low pressure of the atmosphere; but it does not necessarily follow, that there will be rain because the barometer is falling, or fair weather because it is rising. Its movements must be closely studied, and due regard paid to local conditions, before this instrument can be of much assistance in foretelling changes in the weather.

The actual facts of science are so wonderful that it is hard to distinguish them from the imaginative or careless statements made by persons possessed of that dangerous thing, "a little knowledge." In this field a paper like the *Science News*, which gives accurate scientific information in a popular and easily understood style, is especially useful, and no "superstitions," whether scientific or otherwise, will ever find any support in its pages.

[Specially reported for the *Science News* from the Observatory of the College of New Jersey.]

ASTRONOMICAL PHENOMENA FOR JUNE, 1887.

THE sun enters the sign Cancer, and summer begins, June 21 at 1 P.M. Mercury is not in good position for observation; but it reaches its greatest eastern elongation on June 30, when it is nearly 26° east of the sun. It is then several degrees south of that body, and, under favorable conditions, it may possibly be seen low down in the western sky soon after sunset. Venus is still slowly increasing its apparent distance from the sun, and will reach its greatest eastern elongation during July. It is by far the brightest object in the western sky, and sets about three hours after the sun. Mars is a morning star, but is too near the sun to be seen. Jupiter passes the meridian at about 9 P.M. on June 1, and at about 7 P.M. on June 30. It is nearly stationary among the stars, moving slowly westward until June 22, and eastward after that date; but the whole motion is considerably less than 1°. It is about 5° east of the first-magnitude star Spica (*Alpha* Virginis), and a little to the north. The sun is rapidly overtaking Saturn, both bodies moving eastward among the stars. At the beginning of the month Saturn sets about three hours after the sun, and at the end of the month only about an hour after. It is still in the neighborhood of Castor and Pollux, but farther to the east than it was during May. On June 1 it is nearly due south of Castor, the northern and western star. By the end of the month it will have moved to a position 1° east and 7° south of Pollux, the southern and eastern one. Uranus is on the meridian at 8 P.M. on June 1, and at 6 P.M. on June 30. It is in duaqrature with the sun on June 29. It is nearly stationary during the month, and is about 2° south and 1° west of the third-magnitude star *Gamma* Virginis. Neptune is a morning star, but too near the sun for easy observation.

PRINCETON, N.J., *May* 3, 1887. M.

METEOROLOGY FOR APRIL, 1887.

TEMPERATURE.

AVERAGE THERMOMETER.		Lowest.	Highest.	Range.
At 7 A.M.	37.90°	24°	54°	30°
At 2 P.M.	52.07°	29°	75°	46°
At 9 P.M.	39.87°	27°	60°	33°
Whole month	43.28°	24°	75°	51°
Second average	42.43°	24°	75°	51°
Last seventeen Aprils	44.83°	38.17°, in 1874.	50.61°, in 1873.	12.44°
Second average	44.18°	37.71°	50.01°	12.30°

The 18th was the coldest day in the month, and the 10th the warmest, averaging 29° and 61° respectively. The lowest point reached was 24°, on the 6th, and the highest 75°, on the 10th. The least range was 1°, on the 2d, a cool day, with an average of 29⅔°. The entire month was 1.55° below the average of April in seventeen years, and

the lowest, with four exceptions, during this period. With a remarkably cold winter, followed by March and April below the average, we are not surprised to find a rather backward spring.

SKY.

The face of the sky in 90 observations gave 49 fair, 12 cloudy, 17 overcast, 7 rainy, and 5 snowy, — a percentage of 54.4 fair. The average fair sky for the last seventeen Aprils has been 50.8, with extremes of 32.2 and 70. The number of snowy observations (5) has been exceeded but once in April during the last seventeen years. Snow fell heavily all day on the 2d, attended with strong north-east winds. Thunder and lightning were noted on the afternoon of the 29th, continuing about two hours, with slight rainfall.

PRECIPITATION.

The amount of rainfall the past month, including 14 inches of snow melted, was 4.04 inches. Nine inches of snow fell on the 2d, and sleighs were out for a few hours on the following day; 5 inches fell on the 18th, but soon disappeared. The average amount of precipitation in April for nineteen years has been 3.98 inches, with extremes of 1 20 and 8.50. The amount since Jan. 1 has been 24.73 inches, while the average for these four months in nineteen years has been only 18.73.

PRESSURE.

The average barometer the last month was 29 926 inches, with extremes of 29.18, on the 29th and 30th, and 30.50, on the 8th. The average pressure in April in fourteen years has been 29.880, with extremes of 29.767 and 30.078. The sum of daily variations the last month was 6.88 inches, giving a large average daily movement of .229 inch. This average for the last fourteen Aprils has been .177, with extremes of .147 and .239, the only instance larger than that of the present year. The larger daily movements were .63, on the 2d, .50, on the 26th, and .45, on the 3d, all in connection with stormy weather.

WINDS.

The direction of the wind in 90 observations gave 17 N., 3 S., 7 E., 20 W., 9 N.E., 19 N.W., 3 S.E., and 12 S.W., an excess of 27 northerly and 32 westerly over the southerly and easterly, indicating the prevailing direction to have been W. 40° 37′ N. The westerly winds have uniformly prevailed over the easterly in April, with two exceptions, in eighteen years, by an average of 24.39 observations, and the northerly over the southerly, with one exception, by an average of 20.67; indicating the general direction of the wind in April to be W. 33° 57′ N., or N.W. by N. The longitudinal extremes have been 41 E. and 54 W.; the latitudinal, 9 S. and 54 N. The relative progressive distance travelled by the wind the last April was 41 87 units, and during the last eighteen Aprils 529.2 such units, — an average of 29.40; showing less opposing winds the past month than usual.

D. W.

Natick, *May* 5, 1887.

Correspondence.

Brief communications upon subjects of scientific interest will be welcomed from any quarter. The editors do not necessarily indorse all views and statements presented by their correspondents.

FIRES FROM STEAM-PIPES.

Editors Science News:

Referring to the query in the April number as to whether wood can be ignited by steam-pipes, I would say, that some few years since, one of the steamboats plying on the Willamette River had the pipe to the steam-whistle pass through the forward cabin, and in contact with the wood of the roof.

When under way, and when several persons were sitting in the cabin, the wood of the roof suddenly burst into flames. This I did not see, but had it from the captain, who is thoroughly reliable; but I inspected the charred wood. There appeared no possible chance for any sparks to reach it, as every thing was securely guarded.

Since that time a large grain warehouse at this place had the boiler-room in a small building, separate from the main building, with whistle-pipe passing through the shingle roof. One day, being in this room, and noticing the steam-pipe in contact with the wood, I warned them of the danger; but the engineer scoffed at the idea of steam firing wood, and gave no attention to the warning. The next day the roof took fire around the pipe, but was extinguished. The following day fire broke out again at the same place.

In this case there was a possibility of sparks igniting the wood, but it is very unlikely that such was the case.

Respectfully,

Geo. Mercer.

Corvallis, Ore, *April* 5, 1887.

IVY-POISONING.

Editors Science News:

I have always been extremely susceptible to the poison of poison ivy and oak so as to give me great annoyance, unless it is immediately checked on its first appearance. This, common washing-soda accomplishes for me, if properly applied. I make the application by saturating a slice of loaf-bread with water, then cover one surface with soda, and apply to the eruption, the soda next the flesh. When the bread is dried by the animal heat, I drop water on the outer side so as to keep it thoroughly moistened, and dissolve the soda crystals in contact with the skin. This, you will perceive, is merely a bread poultice; the bread being a vehicle through whose moisture the soda reaches the humor. I find that washing or bathing with soda-water, even continuously, will not suffice with me. My skin requires the heat and moisture of the bread in order for the soda to act on and neutralize the poison. I rarely have need to retain this soda poultice for more than thirty minutes on any affected part. No pain ensues. Formerly I suffered often for weeks, as the poison would spread all over my body. Now thirty minutes measures the duration of its exhibition.

R. S. Lacey.

Washington, D.C., *April* 28, 1887.

QUESTIONS AND ANSWERS.

Letters of inquiry should enclose a two-cent stamp, as well as the name and address of the writer, which will not be published.

Questions regarding the treatment of diseases cannot be answered in this column.

W. H. R., *Virginia.* — Is it true that electricity can be used to separate gold from its ores?

Answer. — It is used to a limited extent for this purpose, but it is only in special cases that the process is commercially profitable.

D. S. M., *Watertown.* — Is it the amylic alcobol, or œnanthic ether, in wines and liquors that causes the disease of drunkenness?

Answer. — The "disease of drunkenness" is caused by the ethylic or common alcobol in the liquors. Amylic alcohol, or fusel-oil, is a dangerous and poisonous impurity, and is present in the largest proportion in the poorer and cheaper grades. Œnanthic ether is found in naturally fermented wines, to which it imparts a peculiar and agreeable flavor. It probably does not increase their intoxicating properties.

D. W., *Natick.* — The exact length of the tropical year for 1887 is 365 days 5 hours 48 minutes and 45.38 seconds. At present it is decreasing at the rate of 0.00539 second per year. The interval between two successive new moons was, in 1850, 29 days 12 hours 44 minutes and 2.684 seconds. This period has slightly decreased since then — not far from one-tenth of a second.

A. M. T., *New York.* — What will clean figures of Parian marble and alabaster which have become somewhat soiled?

Answer. — Parian marble can be washed with soap and water without injury. The same materials can be used upon alabaster; but care should be taken, as it is very slightly soluble in water. Common benzine might prove effective.

H. P. N., *Chelsea.* — Ozone is a very unstable body, and quickly oxidizes organic matter. We do not believe it would be possible to preserve it in solution in any liquid hydrocarbon compound.

Large versus Small Wheels. — J. M. makes the suggestion, that the friction on the axle of a small wheel is greater than on that of a large one, as the distance traversed by the small wheel in a single revolution is proportionally less, while the amount of friction remains the same. This is doubtless, practically, a point in favor of large wheels; but, as a theoretically perfect wheel would turn without friction, it does not contradict the statement made in this column in the preceding number.

LITERARY NOTES.

Agriculture in some of its Relations with Chemistry. By F. H. Storer, professor of Agricultural Chemistry in Harvard University. 2 vols. Price $3.00. Published by Charles Scribner's Sons, New York. For sale in Boston by W. B. Clarke & Carruth.

The author of this work says, in his preface, that it is written in the interest of persons fond of rural affairs and agriculture, but makes no special appeal to chemists. Nevertheless, it is written in a thoroughly scientific spirit; and its eminently practical character is so combined with the theoretical teachings of agricultural chemistry, that it will be of equal value to the student of chemistry and the cultivator of the soil. The subject of "plant-feeding" is naturally given the most attention; and with the discussion of the different forms of natural and artificial fertilizers, much valuable information is given regarding the plant itself, the manner of its growth, the culture of different crops, the treatment of the various soils, and the fertilizers best adapted to each.

Professor Storer's work is in every sense a notable contribution, both to chemistry and agriculture, and every intelligent farmer will profit by a perusal of it.

A Friend in Need: or, A Household Guide in Health and Disease. By "Doctor Frank." Price $3.00. Cupples & Co., 94 Boylston Street, Boston.

This excellent work is not by any means to be classed with the cheap and worthless "medical guides" and similar publications, but treats of medical and bygienic matters in a popular style, and gives much valuable information concerning the laws of health, diet, personal hygiene, food for invalids, nursing the sick, and management of a sick-room. No mere printed directions can, of course, take the place of a physician; but a perusal of this book will show how, in many cases, to avoid the diseases which necessitate his services; and in emergencies, or where professional assistance cannot be obtained, the information given may prove of the utmost value.

The Health of our Children, and *Health in our Homes*, by the same author, and for sale by the above firm at 75 cents each, are also to be mentioned as unusually good and sensible books, and free from the extreme and foolish ideas which characterize the writings of so many professional hygienic "reformers."

We may mention, in passing, that the firm of Cupples, Upham, & Co. has been dissolved, and the new firm of Cupples & Co. continues to carry on the publishing department at 94 Boylston Street, Boston, under the charge of Mr. J. G. Cupples, the senior member of the former firm.

The Report of the United States Commissioner of Education for the Year 1884-85 contains much important information, which will be of special interest to teachers, and others engaged in educational work.

Pamphlets, etc., received: *The Camera and Field Ornithology*, and *The Veterinary Service of the United States Army*, by R. W. Shufeldt, M.D.; *Report of the Committee on Disinfectants, of the American Public Health Association; Notes on Brewing*, by James Walker; *Twenty-Ninth Annual Announcement of Long Island College Hospital; Reports of the Minnesota State Board of Health and the Massachusetts Agricultural Experiment-Station; Circulars of Information of the United States Bureau of Education;* and the *Quarterly Report of the Chief of the Bureau of Statistics at Washington.*

Medicine and Pharmacy.

SLOW MENTAL DEVELOPMENT AS SEEN IN "DULL BOYS."

No fact in the operation of mental phenomena is more apparent to the intelligent observer than the slow development of intellectual power. This is especially noticed in that unfortunate class popularly called "dull boys." We find them at home, in the schoolroom, and in the shop; and they are often the butt of ridicule among their more brilliant associates, and not unfrequently teachers lose their patience, and call these unlucky fellows "dunces" or "stupid blockheads." Let us be patient with such subjects, for the condition arises from no defect in the mental or physical organization, but is the result of a curious condition of development; and, if we will only wait long enough, we shall find results that are satisfying if not surprising. We find that these dull boys have a hard time in dealing with quicker intellects that comprehend at once what to them seems hard and strange. Bright, quick boys often stride over these slow fellows, and reach the top of the ladder while their duller companions stumble and falter on the lower rounds; and often invidious comparisons are made by parents and teachers, and the relative merits of bright Tom and dull John are contrasted, with painful odds against the slow and unfortunate John. Nowhere is this contrast so sharply defined as in the schoolroom. It is natural for teachers to like the bright, quick scholar, and this brightness often covers a multitude of defects in character. It is quite natural to assume that the precocity of the bright boy is due to faithful teaching, and the stupidity of his dull companion is often attributed to laziness or indifference.

Now, we say, that, unless a boy is either obstinately lazy or actually deficient in mental capacity, his dulness should be dealt with in hopeful patience. Because he does not easily take in the technicalities of certain studies, it does not follow that he is wholly deficient. He may be bright in comprehending numbers, but dull as lead in grammar or physics; and still his general power for comprehension may be as reliable as that of the most fluent memorizer in school. This fact of slow development must never be lost sight of in our general estimate of probable results. The dull boy in school often becomes the level-headed business-man and the reliable citizen. He may never be brilliant, but he may possess the solid elements in his mental organization that will enable him to wisely conserve the forces around him. We can all recall many such instances among our schoolmates and acquaintances. They were slow, but they kept pushing on; and, amid the derision of their more brilliant early associates, they overcame obstacle after obstacle, until they reached honorable and successful positions in the community.

One of the most able and successful civil engineers in the West was considered a hopeless dunce in school; and the man who is at the head of a large railroad system, and who has shown consummate skill as a manager, was outstripped by a score of precocious boys who were considered the pride of the school and the delight of the master. A dull boy who is ambitious to do something in the world, will be industrious and persistent, — a kind of plodder, and no doubt very commonplace and practical; but his very purpose to accomplish something will give him method in all he attempts, and the results of his life will be positive and well defined.

It is of vital importance that those who have the care of the young should early discover the difference between *absolute deficiency* and *slowness of perception*. Many a poor fellow is mortified and discouraged because of the odds between him and his voluble competitor. It is a happy thing when the plodding boy falls into the hands of a wise and large-hearted educator, who can discern the mental capabilities of his dull pupil, and understand how to assist in their development. Children who come before the public in speech and song before they have reached their teens, and who astonish crowds by their bright sayings and brilliant ways, seldom mature into strong and well-balanced characters. They flash and shine for a while, and are then lost sight of before they reach maturity. The boy whose hand is always up to answer every question that his dull neighbor is pondering, often bears off the palm for scholarship; he gets all the medals, and pockets all the "rewards of merit." He can memorize and recite scores of standard selections, and is always to the front in every display of youthful smartness and precocity. But it is an injury to such boys when they are pushed to their maximum, and made to serve every occasion with the novelty of their brilliant gifts.

Such subjects mature too quickly, and their strength often fails at the supreme moment of manly development. Any system, then, is defective which assumes that all boys must be subjected to the same kind of mental discipline, without reference to the susceptibilities of nervous organization, or the wide divergences of the power of imagination. The *individual* must be recognized and carefully studied if we would make the most of those forces that lie hidden from careless observation. This should be a fundamental principle in all dealings with mental training; and upon the right application of this sentiment will depend the healthy development of many a boy who, in the records of modern school-life, is written down as "slow, dull, and stupid."

HOUSE-DRAINAGE.

BY MAURICE D. CLARKE, M.D.

PART I.

IT is wise not to impute all our sanitary sorrows to sewers, lest we prove too much. The ordinary suburban city of moderate size is not likely to have a dozen houses either perfectly plumbed or perfectly ventilated, while those that are both well plumbed and well ventilated could probably be counted on the fingers of one hand. So that, assuming this to be truth, or even an approximation to the fact, pestilences ought to be rather frequent, if we were to believe what some say about sewers; while in actual life we get along tolerably well, in spite of this never-absent source of danger. On the other hand, the weight of opinion is certainly against sewer-gas; and the researches of competent investigators, especially in England, leave little room to question its prejudicial effect upon those who daily breathe it. And, when it came to the point, it is highly probable that the most conservative and sceptical would prefer not to have an untrapped sewer open into their bedrooms. So that, for the purposes of this article at least, it will be taken for granted that the presence of the products of decomposing organic waste is undesirable, and it will merely be considered how best to escape it.

Our main concern will necessarily be with the drainage of cities, since, although the question of a proper disposal of their organic *débris* is far from being without interest to residents of the country, yet their conditions, since the smaller towns usually have no water-supply under head, are so different from those of cities, that the two cannot well be considered together except at some length. And, as the cities in this region are not likely at present to make any other disposal of their sewage than to empty it into the handiest waterway, there is left to us to consider how best to get it from its source to the water. At first sight, it would seem simple enough to lay pipes at the right angle, empty the refuse into them, and, with a good flush of water, sweep it off to the outlet. But the thousand and one appliances that practical men and theorists, engineers and architects and plumbers, have contrived to aid the process, suggest difficulties somewhere. In very truth, of the making of faucets and traps and bowls and pipes there is no end.

It ought to be said, however, that, in spite of this multiplicity of apparatus, and in spite of the multiplicity of belief that it implies, it conveys a false impression. There is at present, whatever differences may arise in future, a very general agreement as to the principles of drainage: and what dispute there is, is mainly confined to matters of detail; important enough, to be sure, but not fundamental. That is, if a sanitary expert was instructed to plumb a house, unrestricted as to expense, he would have no doubt as to the ends he expected to gain or the general method of attainment; his only question would be as to special agencies. One man, fond of luxury and convenience, would scatter fixtures over his house at frequent intervals, confident in the protection afforded by modern appliances. Another would sacrifice comfort to his belief that the maximum of safety demands the minimum of appliances. Each might prefer a different trap, water-closet, wash-basin; but all, in preferring them, would be intending the same result. All would be apt to indorse such a statement of belief as the following, propounded by a well-known sanitarian, Col. Waring: "The perfect drainage of a house, like the perfect drainage of a town, implies the immediate and complete removal, to a point well beyond its limits, of all waste matters which are a proper subject of water-carriage; such a thorough ventilation of the channel which these matters have traversed as to reduce to a minimum the production of deleterious gases arising from the decomposition of the film with which they may have soiled the walls of their conduit; and adequate provision for the absolute and permanent exclusion, from the atmosphere within the house, of the air of the pipe or sewer."

Apt illustrations of "how not to do it" occur in the experience of every sanitarian. A case within the knowledge of the writer is noteworthy for the apparently intimate relation of cause and effect.

A child, on a visit to relatives, was seized with diphtheria, and, hopelessly ill from the first, died in three days. This suggested an examination of the plumbing arrangements, which had been put in forty years before, and about which nobody knew any thing. Inspection revealed a state of things about which there could be no dispute, and yet which had till then been unsuspected. There was not a trap in the house except the one under the water-closet, and just below this the waste-pipe from the bath-tub entered. The closet was the old-fashioned "pan-closet," now generally and deservedly condemned. The soil-pipe was leaky in several places. Some of the waste-pipes ran into an open drain in the cellar that had once been carried through the wall into the street, but had become broken and stopped up, so that its contents spilled over upon the cellar floor. There was no ventilation to the pipes except as they ventilated themselves into the house. If ever there was a place destined for the source of the so-called "filth diseases," where every room was eloquent with warning, this was it. And the owner, like hundreds of others, had no occasion to doubt his security till a fatal accident revealed the danger.

Now, there are some things that may fairly be insisted upon by advisers in sanitary matters who are not sanitary prigs or dogmatists.

In the first place, it is to be borne in mind that the chief source of sewer-gas in houses is probably, not the street sewers, but the pipes in the houses themselves. These are apt to be laid either vertically or horizontally, instead of on an inclined plane, and are therefore more easily fouled. In the vertical pipe the water falls so rapidly as often to fail to clean the sides, while the slow current of the horizontal pipe allows the deposit of sediment. The best results are believed to be attained by a compromise between the two, which in the ordinary dwelling-house is very difficult of attainment. So that the street-sewer occupies a different position in the eyes of sanitarians from its former one. It used to be supposed that the sewer was the main source of our domestic woes, and that, to be safe, we needed only to devise an effective means of keeping its noxious products out of the house. It is not unlikely, however, that we should be surprised at the comparative purity of well-flushed sewers; and it is now the accepted belief that a larger danger lurks in the house-pipes. And this danger compels the placing of a trap under every fixture, as close to the inlet of the waste-pipe as possible, so as to reduce to a minimum the length of the pipe between the fixture and the trap. So much, at least, might be more or less thoroughly washed and disinfected. This marks a radical change in methods of plumbing. The outlet from the house used to be trapped; but the many feet of inner piping, covered with decomposing slime, were left freely open to the house. Under present methods, the piping, except the few inches between the fixtures and the traps, is virtually outside of the house, if the traps are a real protection.

In the second place, although it was little heard of, and certainly disregarded, until within a few years, modern belief attaches great importance to the ventilation of the piping. It is well understood that the best method of disinfection is dilution with pure air. Therefore, if pipes get foul, — and more or less foul they must get, — the best way to avoid danger from them is to flush them with fresh air. To that end, the main soil-pipe is finished by carrying it up through the roof, and leaving it open like any other ventilator; aiding the current by another opening just before it enters the house, instead of closing it tight, as it used to be, and as it may be found now in many of our older houses. In those days, if for any reason there was any setback in the sewers, — if, for example, the rising tide choked their outlets, or adverse winds blew into them beyond the venting capacity of the man-holes, — there was nothing left for the noxious gas to do but to retire within the houses. The traps did not stand in the way, since the pressure was often great enough to break their seals. The present method, however, gives us a set of pipes shut off by traps from the house, and opening into a ventilated soil-pipe whose open end affords ample room for escape from a set-back of gases.

These two things are among the most important reforms of latter-day plumbing; and the sanitary expert would tell the man who came to him for advice, that, if he had done these, he had done a great deal to assure himself protection, provided his traps were good ones: upon which the latter would naturally ask what traps were good, and would unwittingly enter upon a boundless sea of inquiry. No well-educated sanitarian, engineer, or architect but has invented, or thought of inventing, a trap, — very few of them good, a large number of moderate value, many of them worse than useless under ordinary conditions. One of the leading experts (Waring) makes this *naïve* confession: "I took out a patent for a trap of this sort myself some years ago, — probably one of the least successful of the whole list." It would obviously be without the province of this article to endeavor to decide which particular trap deserved pre-eminence. Traps are articles of commerce, and the buyer must decide for himself whether he will have Smith's or Jones's. There are certain general principles about traps, however, which he may well bear in mind, if he does not obtain expert advice. These will be considered in a continuation of this article.

Haverhill, Mass., *April* 1.

MONTHLY SUMMARY OF MEDICAL PROGRESS.

COMPILED EXPRESSLY FOR THE SCIENCE NEWS BY W. S. WELLS, M.D.

Broncho-pneumonia in children has been treated, during the past winter, with ipecacuanha to the extent of vomiting the patient occasionally. This has been found very serviceable in the hospitals in Paris devoted to children. Bromide of potassium is given to quiet the cough, and mild forms of counter-irritation are applied to the chest.

We have used similar treatment in cases of broncho-pneumonia in adults here in New York, and have found sirup of ipecacuanha (3i.) with pulv. mur. ammoniæ (Gr. j.), hourly, sufficient to relax the bronchial tubes, and by occasional vomiting empty the air-passages of accumulated secretions, induce perspiration, and lower the pulse.

Counter-irritation with a mustard plaster over the seat of pain or constriction of the chest, and a Dover powder at bed-time, is to be followed the next day by a repetition of nausea and vomiting induced by continued doses of the ipecac mixture; and this repeated nausea and vomiting will soon abate the pulmonic fever.

The mur. of ammonia is not needed in every case, unless the patient is too weak to expectorate after coughing. It is especially useful if the patient has been intemperate, and this plan has succeeded well in the pneumonia of drunkards. The frequent nausea subdues the fever, and greatly facilitates the expectoration of bronchial secretions.

In the performance of tracheotomy, Dr. W. L. Braddon, London, offers the following suggestion. —

Let the surgeon place his left hand, as widely expanded as possible, over the neck of the child in position for tracheotomy; then, resting the fingers upon one side of the windpipe, and the thumb on the other side, pressed upon the skin, draw in the thumb and fingers towards the median line. As the sides of the windpipe are approached, a little more pressure made in a backward direction will place the ends of thumb and fingers in a position in which they almost meet behind the windpipe, bringing it forward, standing out prominently under the skin which is thus stretched over the site of incision. By this method the windpipe is raised and made prominent, and there is no danger of wounding the great bloodvessels, or coming in contact with the vertebral bodies, as has happened.

There is little if any discomfort; and the younger the child, the more easily may the windpipe be thus isolated when required to be opened, as in croup.

A case of inflammation of the liver, with dropsy, in which direct bleeding from the liver was performed, was reported by Dr. Harley to the British Medical Association. The operation consisted of piercing the upper part of the liver, from right to left, with an eight-inch trocar, about the size of a No. 3 English catheter; the hope being, that, during its transverse penetration, one or more veins or arteries might be wounded, and thus the liver be tapped of its superfluous blood. This was realized, and twenty ounces of blood removed with most salutary effects; the patient recovering completely from the hepatic inflammation and dropsy. The operator sealed the abdominal puncture with sticking-plaster, and bandaged the abdomen tightly, with the view of closing the wound in the liver by compression against the abdominal parietes.

M. Bronardel of Paris has reported on an endemic of typhoid-fever at Pierrefonds, a resort near Paris, and finds it was caused by drinking water from wells, the contents of which were polluted by exudations from cesspools in their neighborhood.

Of twenty-three Parisians who went there, twenty were attacked by typhoid-fever; while it does not appear that the inhabitants, accustomed to the water, were affected. It would seem that in this instance immunity followed acclimatization. As impure water is known to be capable of conveying the germs of cholera, dysentery, and typhoid-fever, it behooves strangers to be very careful about drinking well or spring waters, and, if practicable, procure bottled mineral waters. If not, boil and filter the well or spring water, and aerate it.

Anæmia becomes the prominent condition in many diseases ending fatally, without the cause of the impoverished state of the blood being discovered. Dr. Runeberg believes the presence of intestinal worms may account for many of these cases. In the Helsingfors Hospital he saw nineteen cases of penicious anæmia, in twelve of which he found tapeworm, and in one lumbricoid worms.

Remedies were directed to the destruction of the intestinal parasites, and but one of the patients died.

It is advised to examine the stools of patients with decided anæmia, and, if the eggs or portions of the parasites are discovered, administer vermifuges thoroughly.

Dr. Watson Smith, London, reports the case of his own boy, critically sick with dysentery, and the stomach so sensitive that vomiting was excited immediately any attempt was made to administer any thing. The doctor then thought of the sedative effect of perfumery, and argued, that, if he could so deceive the patient as to cause the imagination to attribute to the article administered the delicate flavor of the perfumery, the effect upon the olfac-

tory nerves would be soothing upon the nerves of the palate and stomach.

Some simple diet was given in a spoon held with a handkerchief upon which a delicate perfume was sprinkled. The effect was excellent, and after a short time medicines could be given in the same way, and were retained without further disturbance of the stomach, and the patient rapidly recovered.

This plan of masking the sense of taste through the influence of perfumery upon the olfactory nerves may be equally pleasant to adults.

ANOTHER contribution to the surgery of the lungs is reported by Dr. A. Casini, the patient being a man forty years old, an inmate of the Hospital for Incurables at Naples. Examination revealed the presence of an apparently superficial cavity in the right mammary region, extending from the third to the fifth intercostal space. There were night-sweats, fever, cough with purulent expectoration, diarrhœa, and all the other general symptoms of tuberculosis.

Examination of the sputa showed the presence of tubercle bacilli. Dr. Casini resected the fifth rib, opened the cavity, and washed it out with a disinfectant solution. Subsequently the parts were treated with insufflations of iodoform and irrigations of a one to a thousand solution of corrosive sublimate.

The expectoration at once diminished in quantity, and within ten days had lost its purulent character, while no more bacilli were found. He is now well.

FROM numerous experiments, Dr. Bolshesolsky of St. Petersburg concludes that biniodide of mercury is a more powerful and less poisonous antiseptic than corrosive sublimate; confirming the observations of Bernhardy. A solution of one in four thousand destroys putrefaction microbes more completely than a sublimate solution of one in two thousand.

THE Paris correspondent of the London *Lancet* writes, that, at a recent meeting of the Société de Therapeutics M. Martineau reported that he had been treating cases of diabetes for the last ten years, with almost invariable success, by a method he had borrowed from a practitioner now dead, and had waited disclosures in order to be quite certain that his conclusions were not premature.

The treatment consists in the administration of a carbonate of lithia solution with arseniate of soda, in aerated water, to the exclusion of other drinks. Besides taking this with his meals, the patient uses the same as a beverage when thirsty at other times. M. Martineau affirms that this regimen has cured sixty-seven of seventy patients under his care.

DR. N. S. BATES, in the *American Journal Medical Science*, reports cases of intestinal concretions resembling black sand, — hard, sharp, and gritty, — which were finally identified as the cells of the banana fruit. It will be well to avoid this fruit in intestinal troubles, as mechanical irritation might be caused thereby, and an aggravation of the complaint follow.

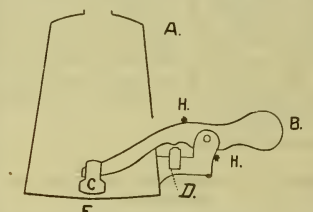
THE correspondent of the *Chicago Medical Journal* writes that Professors Pean, Bergmann, and Guyon perform the suprapubic section for stone, and nearly all teachers and operators in Europe discard the perineal section. They crush small calculi, and remove larger ones by the high operation.

DR. ESCORILEADA records, in *El Genio Medico Quirurgica*, a case of extreme anæmia with anorexia occurring in a female patient, aged twenty-nine, in which defibrinated and diluted bullock's blood was given in the form of spray by inhalation, the defibrinated blood being in the proportion of eighty per cent to twenty per cent of salt solution; the latter containing seventy-five one-hundredths per cent, as recommended by Jubini. Other treatment had failed to improve the nutrition, but visible improvement was noted after four inhalations. Cold sea-water affusion was also employed.

AN IMPROVEMENT IN STETHOSCOPES.

THE advantage of a combination of the percussion-hammer and pleximeter with the stethoscope, especially in cases of internal organs whose changed dimensions are sought for by the sound emitted, is too evident to require argument. The difficulty appears to have been in combining them, and at the same time preserving the peculiar sharp, quick blow and *recover* of the practised wrist and hand.

The improvement here shown combines the two, and gives the sharp blow and rebound perfectly simulated, and — what the hand does not — uniformly. The improvement consists in adding to the bell of the stethoscope a bracket to support a lever controlled by a spring. This lever, pivoted to the bracket, plays in a slot in the bell, and terminates in a brass tube holding a rubber head to form a hammer, *C*. Across the bottom of the bell a strip of hard rubber or other suitable material, *E*, is fastened. This strip is slightly convex, so as to be tense when pressed on the body, and is about three-fourths of an inch wide; the hammer strikes the centre of this strip.



A, bell of common stethoscope; *B*, hammer lever; *C*, rubber hammer; *D*, rebounding anvil; *E*, pleximeter; *H.H*, fulcrum points of spring in place.

In use, the stethoscope is applied as usual; the lever, *B*, is pressed down and set free by the finger of the right hand; the spring acts on the lever to strike a blow on the central strip, or pleximeter; and the hammer is instantly rebounded, and held from the pleximeter by the rubber cushion or rebounding anvil *D*, thus giving a clear, quick, distinct sound.

If the pleximeter is too sonorous, it can be joined to the bell by two slots, and packed with thin, soft rubber.

The lever should be suspended, and work so as to make no sound of its own.

A device that, for many purposes, I consider superior to the soft rubber bell, is to spring over the edge of the bell of the common stethoscope a rubber band or ring. It will retain its place, and be found equal to the soft bell in deadening the friction sounds of clothing, etc.

EDW'D P. ROCHE, M.D.

BATH, ME., *May* 1, 1887.

A TRUE PROGNOSIS. — "Stop smoking," said a doctor to an ailing patient the other day, "and it will lengthen your days." The patient stopped. The doctor's prediction was verified. The first day, the patient declares, was as long as his whole previous life; and he was inclined to favor the idea of "a short life and a merry one."

The Popular Science News.

PUBLISHED MONTHLY BY THE

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SETH C. BASSETT,

MANAGER.

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PROFESSOR DR. R. FRESENIUS of Wiesbaden, Germany, has made an analysis of MELLIN'S FOOD FOR INFANTS AND INVALIDS, of which the following is a summary: —

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albuminoids	9.75
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moisture	13.32
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THE *London Lancet*, the leading medical journal of England, recommends NESTLÉ'S MILK-FOOD FOR INFANTS AND INVALIDS. It is extensively used abroad, and is meeting with equal success in this country.

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Yours truly,

RALPH HICKS.

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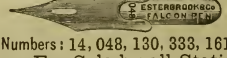

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CONTENTS.

FAMILIAR SCIENCE. — Strikes and the Industrial Organization 93
Scientific Recreations 94
Field Geology 94
Weather Lunacies 96
PRACTICAL CHEMISTRY AND THE ARTS. — The Distribution of Arsenic 97
How to make a Pocket Accumulator 97
Rifle Barrels 98
Remarkable Specific Gravity of Lime-Water 98
A Simple Sulphuretted Hydrogen Apparatus 98
Cheap Manufacture of Sodium and Potassium 98
Laboratory Notes 98
HOME, FARM, AND GARDEN. — The Buffalo Carpet Beetle .. 99
The Mysteries of Plant-Growth 99
Gleanings 100
EDITORIAL. — Errors of Nomenclature 101
Optical Illusions 101
Astronomical Phenomena for July, 1887 102
Meteorology for May, 1887, with Review of the Past Spring 102
Paris Letter 103
The Civet 103
Tungsten Steel 104
Questions and Answers 104
Literary Notes 104
MEDICINE AND PHARMACY. — Physical and Mental Development in the Average Boy 105
House-Drainage 105
Monthly Summary of Medical Progress 106
Controlling Patients under the Influence of Nitrous Oxide, 107
Olfactory Acuteness 107
The "Revolver Cure"? 107
A Doctor who could Shoot 108
Humors 108
PUBLISHERS' COLUMN 108

Familiar Science.

[Original in *Science News.*]

STRIKES AND THE INDUSTRIAL ORGANIZATION.

BY PROFESSOR W. G. SUMNER.

ANY one who has read with attention the current discussion of labor topics, must have noticed that writers start from assumptions, in regard to the doctrine of wages, which are as divergent as notions on the same subject-matter well can be. It appears, therefore, that we must have a dogma of wages, that we cannot reason correctly about the policy or the rights of the wages system until we have such a dogma, and that, in the mean time, it is not strange that confusion and absurdity should be the chief marks of discussion carried on before this prime condition is fulfilled.

Some writers assume that wages can be raised if the prices of products be raised, and that no particular difficulty would be experienced in raising prices. Others assume that wages could be raised if the employers would be satisfied with smaller profits for themselves. Others assume that wages could be raised or lowered according as the cost of living rises or falls. These are common and popular assumptions, and have nothing to do with the controversies of professional economists about the doctrine of wages. The latter are a disgrace to the science, and have the especial evil at this time that the science cannot respond to the chief demand now made upon it.

If the employer could simply add any increase of wages to his prices, and so recoup himself at the expense of the consumer, no employer would hold out long against a strike. Why should he? Why should he undertake loss, worry, and war, for the sake of the consumers behind him? If an employer need only submit to a positive and measurable curtailment of his profits, in order to avoid a strike, and secure peace, it is probable that he would in almost every case submit to it. But if the employees should demand five per cent advance, and the employer should grant it, adding so much to his prices, they would naturally and most properly immediately demand another five per cent, to be charged to the consumers in the same way. There would be no other course for men of common sense to pursue. They would repeat this process until at some point or other they found themselves arrested by some resistance which they could not overcome. Similarly, if wages could be increased at the expense of the employer's gains, the employer who yielded one increase would have to yield another, until at some point he decided to refuse and resist. In either case, where and what would the limit be? Whenever the point was reached at which some unconquerable resistance was encountered, the task of the economist would begin.

There is no rule whatever for determining the share which any one ought to get out of the distribution of products through the industrial organization, except that he should get all that the market will give him in return for what he has put into it. Whenever, therefore, the limit is reached, the task of the economist is to find out the conditions by which this limit is determined.

Now, the character of the modern industrial system is, that it becomes more and more impersonal and automic under the play of social forces which act with natural necessity. The system could not exist if they did not so act, for it is constructed in reliance upon their action according to ascertainable laws. The conditions of all social actions and reactions is therefore set in the nature of the forces which we have learned to know on other fields of scientific investigation, and which are different here only inasmuch as they act on a different field and on different material. The relations of parties, therefore, in the industrial organism is such as the nature of the case permits. The case may permit of a variety of relations, thus providing some range of choice.

A person who comes into the market, therefore, with something to sell, cannot raise the price of it because he wants to do so, or because his "cost of production" has been raised. He has already pushed the market to the utmost, and raised the price as high as supply and demand would allow, so as to win as large profits as he could. How, then, can he raise it further, just because his own circumstances make it desirable for him so to do? If the market stands so that he can raise his price, he will do it, whether his cost of production has increased or not. Neither can an employer reduce his own profits at will. He will immediately perceive that he is going out of business, and distributing his capital in presents.

The difficulty with a strike, therefore, is, that it is an attempt to move the whole industrial organization, in which all the parts are interdependent and inter-supporting. It is not, indeed, impossible to do this, although it is very difficult. The organization has a great deal of elasticity in its parts. An aggressive organ can win something at the expense of others. Every thing displaces every thing else; but, if force enough is brought to bear, a general displacement and readjustment may be brought about. An organ which has been suffering from the aggression of others may right itself. It is only by the collision of social pressure, constantly maintained, that the life of the organism is kept up, and its forces are developed to their full effect.

Strikes are not necessarily connected with violence to either persons or property. Violence is provided for by the criminal law. Taking strikes by themselves, therefore, it may be believed that they are not great evils. They are costly, but they test the market. Supply and demand does not mean that the social forces will operate themselves. The law, as laid down, assumes that every party will struggle to the utmost for its interests. If it does not do so, it will lose its interests. Buyers and sellers, borrowers and lenders, landlords and tenants, employers and employees, and all other parties to contracts, must be expected to develop their interests fully in the competition and struggle of life. It is for the health of the industrial organization that they should do so. The other social interests are in the constant habit of testing the market, in order to get all they can out of it. A strike rationally begun and rationally conducted only does the same thing for the wage-earning interest.

The facts stare us plainly in the face, if we will only look at them, that the wages of the employees and the price of the products have nothing to do with each other; that the wages have nothing to do with the profits of the employer; that they have nothing to do with the cost of living or with the prosperity of the business. They are really governed by the supply

and demand of labor, as every strike shows us, and by nothing else.

Turning to the moral relations of the subject, we are constantly exhorted to do something to improve the relations of employer and employee. I submit that the relation in life which has the least bad feeling or personal bitterness in it is the pure business relation, the relation of contract, because it is a relation of bargain and consent and equivalence. Where is there so much dissension and bitterness as in family matters, where people try to act by sentiment and affection? The way to improve the relation of employer and employee is not to get sentiment into it, but to get sentiment out of it. We are told that classes are becoming more separated, and that the poor are learning to hate the rich, although there was a time when no class hatreds existed. I have sought diligently in history for the time when no class hatreds existed between rich and poor. I cannot find any such period, and I make bold to say that no one can point to it.

SCIENTIFIC RECREATIONS.

MR. WILLIAM SALISBURY describes, in the *Scientific American*, a very interesting experiment in magnetism, which realizes the old legend of Mahomet's coffin, which was said to hang suspended in the air, between heaven and earth.

Take a horseshoe magnet and a common sewing-needle. Insert a light thread in the needle, tie, and cut off one end, leaving a single thread six or eight inches long. Lay the magnet on a table, with poles in front, and

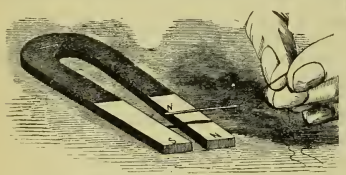

FIG. 1.

magnetize the needle by rubbing it several times, always in one direction, by one pole of the magnet; after each stroke returning the magnet in an arc through the air. Take the end of the thread between thumb and finger, and suspend the needle over its attractive pole, allowing the point to come within one-fourth of an inch of the magnet; then, with a circular sweep of the hand, to keep the point in position, draw the eye of the needle down toward the other pole. This, if carefully done, will bring the needle to a horizontal position, where it will remain, floating or in suspension, as long as the thread is held steadily. The magnetic forces operating to produce this effect appear to be, first, the attraction of the left pole for the point of the needle; second, the repulsion of the right pole for the same point; and third, the attraction of the right pole for the eye of the needle, which is resisted by the thread supporting the needle; the latter also is held from approaching the left pole by the same means.

If a small magnet is used, the point of the needle should be broken off, to reduce it in length. The thread may be held close to the needle; an inch length of free thread is enough. The experiment may be made more effective by covering the magnet with a sheet of paper, thus concealing it.

The second experiment is not very "scientific," but some of our younger readers may be interested in the "magic cent" described

FIG. 2.

FIG. 2a.

in *La Nature*, which can be slipped into a narrow-necked bottle, or removed therefrom, with the greatest ease. Take an old-fashioned copper cent, and cut a groove entirely around the rim. This can be done with a small file, or any machinist can cut it in a minute on a lathe. Then, with a fine scroll-saw, cut the coin into three pieces, as shown in the engraving. Slip a small rubber band tightly around the coin, and it will be hidden by the groove, and be apparently as solid as before. Hold the coin in the hand over the mouth of a bottle; press the sides together, and it can be easily passed within, when the rubber band will cause it to instantly resume its usual shape. It can be removed from the bottle by shaking it sharply, taking care that the divisions cut in the coin are in line with the neck of the bottle.

[Original in *Popular Science News.*]

FIELD GEOLOGY.

BY PROFESSOR N. S. SHALER.

III.

Structure and Attitude of the Bed-Rocks.

IN two previous papers we have considered the work which the student could do upon the superficial portions of the earth. We have seen, that, by observing the effects upon the earth's surface brought about by the forces now in operation, the observer can secure an adequate conception of geological action. We have also considered how, by inquiring into the history of glacial phenomena, he can gain a certain practice in forming those conceptions by which the geologist explains the conditions of the past. In the present paper we shall consider the third step which it is well for the student to take; namely, that which leads him to inquiries concerning the structure and history of those products of ancient geological work indicated in the rocks which form the earth's crust.

It will be well for the observer to begin this study of the underlying rocks with a brief consideration of their history. His previous studies have served to show him how the forces now at work on the earth's surface, or which have recently been in operation there, are competent to break down rocks, convey their materials to a distance from the place where they originally lay, and dispose them in new deposits. He may therefore safely assume that the bed-rocks of the country have been formed by the action of just such forces as he may now observe at work on the earth's surface. In so far as these rocks differ in their aspect and conditions from those which he sees forming at the present day, he may conclude that these differences are due to changes brought about since the beds were buried in the crust.

There are five classes of questions which the student of the bed-rocks will find himself called upon to consider. The first of these relates to the source whence the sediments were derived which have served to build the deposits he is observing. Next, he will have to consider the metamorphism, or the changes in composition which the beds have undergone since the period when they were formed. Thirdly, he will have to inquire into the alterations of position which these rocks have undergone since the time when they were laid down. Fourthly, he will be required to observe the fossils or remains of animals and plants which they may contain. Last of all, he will have before him the questions as to the geological age of these deposits, the succession in which they were laid down, and the period in the earth's history to which they belong.

The first aim of the student in this, as in all his inquiries, should be to secure a clear idea of the regional distribution of the matters which he has to study. He should, as before, avail himself of the best map of his country which he can secure; and from time to time as his work progresses, he must, where it needs amendment, correct the topography shown upon the map. It is well for him to begin his inquiries by placing on the map, by classes, each of the distinct divisions of rocks which he may be able to observe within his field. At the beginning of his study, he had best start with the simpler discriminations which he will be able to make. He will find, for instance, that in most cases he can observe certain manifest conditions in the character of these rocks. It will often happen, that, on the ground he is studying, the two principle classes of rocks, those which are distinctly stratified and those which show no stratification, are to be found.

He may begin his work by instituting this division, marking the limits of each unstratified group of deposits on his map by means of colored pencils, leaving for the time the manifestly stratified deposits such as dike-stones, granites, sienites, etc., as well as those which may appear indistinctly stratified, as gneisses and mica schists. He should devote his attention at first to the stratified rocks, taking in the beginning those portions of such beds as appear to be least changed. The first inquiry which arises in the study of stratified deposits concerns the character of the materials of which they are composed. Ordinarily, in any considerable field of stratified rocks the student will be able to find sandstones or conglomerates, slates or shales, and limestones. A little inspection will show the student that the sandstones, conglomerates, and shales are altogether composed of fragments worn away from other rocks. Beginning with a conglomerate, we perceive that the pebbles are of varied character, and that the mass is essentially like the detrital deposits left by glaciers, or formed by streams of running water or by waves of the sea. A bed of conglomerate is a museum of pebbles; the specimens generally represent in clear manner the bed-rocks from which they were derived, and in many cases the student can determine the source whence these pebbles came by comparing them with the rocks of the neighboring region. If these pebbles be of much size, he may be pretty certain that most of them have not journeyed for any great distance from the place in which they originally lay. The origin of all the numerous conglomerates of New England can be readily referred to localities within a few miles of their present site. If the area of conglomerate be of considerable extent, it

is often possible to note that the pebbles increase in size towards one side of the field occupied by the deposit. If such a fact is observed, we may be tolerably sure that the fragments came from the direction in which they are found in larger dimensions.

Having essayed to determine the point of origin of this detrital material, the student should next undertake to ascertain the forces which rent the fragments from their bed, and brought them to their present position. There are four ways in which pebbly beds may be formed, and each of these ways gives a somewhat different aspect to the deposits. The commonest way, that in which the most extensive body of conglomerates are originated, is by glacial action. If the student dwells in a field occupied by the great glacier of the last ice age, he will be able to note the fact that pebbles formed in this manner are, on the whole, the most angular of all pebbles. It is true that a portion of the glacial waste has been rounded by the action of water; but wherever we observe a large number of glacial pebbles, we note, despite the moderate rounding to which they have been subjected, that their forms remain more or less faceted, and are sharply contrasted with those produced by the action of rivers or the sea.

Pebbles shaped on the ocean shore are commonly very much rounded; they tend to become egg-shaped. Pebbles formed in river-beds are also rounded, and closely resemble those formed by marine action. It is not possible in all cases to make a certain separation of pebbles formed on the sea-shore and those produced by the streams of the land. These two classes of fragments, though differing in the circumstances of their origin, may be grouped together. The last class of fragmental beds which the student is likely to observe is known as volcanic breccias. These breccias have been formed by the explosive action of volcanoes which have thrown quantities of fragments into the air or into the water, and thus formed a bed of detrital materials. Such deposits differ from the three classes before mentioned in the fact that the pebbles are always extremely angular, broken as if by the hammer, and thus have an aspect sufficiently peculiar to enable even the untrained observer to discriminate them. In certain rare cases it is true that these fragments of volcanic origin have been in part rounded by the action of heat, or by rubbing against each other as they were driven out of the volcanic bent. In such cases, however, the student can almost always find in the bed, fragments of pumice — that is, of lava — full of air-bubbles. Where such fragments of pumice occur, it is almost certain that the deposit is of volcanic origin. Few students in the region east of the Mississippi River will have a chance to observe conglomerates of volcanic origin, for such strata are limited, in the main, to the eastern part of New England, the region of the Connecticut valley, or along the Atlantic seaboard.

Turning now to the group of sandstones, the student will find that in many cases he can pass by complete gradations from conglomerates to beds of sand; he may thus see that a bed of sand is composed, as is the bed of conglomerate, of fragmental materials. In the sand the rock has been divided into its ultimate crystals, and these crystals often subdivided into very small bits. Taking up a little of the sand on the wetted tip of the finger, he will observe that the greater part of it is composed of a translucent material. This material is quartz. He will often find small fragments of magnetic iron, bits of felspar, and other granular materials commingled with the quartz. Looking again to his conglomerate, he will find, that, where the pebbles are exposed to the action of the water, they tend to break into the condition of sand; and very little observation on a surface of any crystalline rock will show how rapidly most of our rock materials tend to pass into that state. In certain cases it may be possible for him to trace a bed of conglomerate in a direction in which the pebbles grow smaller and smaller, and the element of sand greater, in quantity, until the conglomerate gives place to a sandstone. Going still farther, he may find that the grains of sand grow smaller, become mingled with clay, and finally he may have clay or slate in place of the sandstone. The most of our clays consist in large part of the fine grains of quartz, but some of them contain a considerable admixture of *hardened* alumina.

The student will have learned, from his previous study of rivers, that this diminution in coarseness of material indicates a progressive decrease in the swiftness in the currents which bore the materials to the places of deposition. He therefore may infer the direction of the carriage from the decrease in the size of the bits composing the sediments. In the sandstones he will generally find another indication of the direction of movement. Looking closely at such deposits, he will generally note that there are two sorts of beds indicated in the deposits. There are certain thick beds which normally lie in a nearly horizontal attitude. Within these he will find thinner beds lying at a considerable angle to the horizon. These smaller beds, the lines of which never cross the thicker beds, are known to the geologist as "cross-beds." We may note the circumstances which led to their formation by observing what occurs where any small stream formed during a summer shower builds a little delta in a temporary pool. The upper surface of the delta constitutes a layer, but a layer which is built by deposits on its outer edge. These deposits vary in character as the stream changes the swiftness of its motion; so, in the successive variations of the stream, even within the limits of a single day of rain, a dozen of these little cross-beds may be constructed. If, now, after an interval, the stream begins to flow again, it may make a second layer upon the top of the first delta, composed also of little cross-bedded strata. That which is done in a small way and in a short time by the variations of a temporary rivulet, is performed in a larger fashion, during a geological age, by a great river such as the Mississippi. The changes in the course of the stream, produced, perhaps, by the changes in the level of the continent on which it lies, have led to the construction of many successive thick beds of its delta which are characterized by subordinate cross-beddings. Where cross-bedding is formed by the action of a river, the steeply inclined strata slope away from the direction whence the detritus was derived. In certain cases the tides produce cross-beds: but when this structure originates in tidal action, we can generally determine the fact from the extremely varied direction in which the cross-bedding slopes; while in the cases where such bedding is produced by rivers, the layers almost always, as before remarked, slope in one general direction.

Where the student is so fortunate as to be able to observe the transitions of a conglomerate into a sandstone, and the sandstone into a clay, he may generally note a fact which will be of great importance to him; viz., that the conglomerate portion of the bed is very much thicker than the sandstone, and the sandstone thicker than the clay. Noting the fact that the given bed, whether conglomerate, sandstone, or clay, has all been deposited at the same time, he may be brought to see that the rate at which deposits are formed varies very much with the conditions of the material composing the accumulation. It is often the case that a layer of conglomerate ten feet in thickness will be formed in the time when a sandstone accumulation only one foot in depth is laid down, and the corresponding clay element of the layer may be less than a tenth of an inch in depth.

After having sought out all the facts of this nature which the distinctly stratified rocks may afford, the student should next turn his attention to the study of those changes which have taken place in the structure of rocks since the time when they were laid down upon the sea-floor. If there exist any rocks which have been melted and f rced into crevices forming dikes, the student should endeavor to trace some of the stratified deposits into contact with these volcanic materials. If the dike be of large size, exceeding ten feet in diameter, he will commonly be able to observe that the sedimentary matter has undergone certain changes at the point of contact with the igneous material. He will find that it has become more compact; it generally is harder to scratch with a knife, and more difficult to break with a hammer. He may find that the bedding planes are in part obliterated. Still further, on close observation, he will often notice that crystals of various sorts have formed in the stratified rock, where it is close to the dike.

In this way the student will be able to see some of the more evident effects arising from the action of heat upon the rocks, and will be prepared to conceive that to this agent we may owe such changes as those which convert ordinary clay slates into mica schists or gneisses, or perhaps, in certain cases, to more perfectly crystalline rocks, such as granites or sienites. In many fields it is possible to find various stages of this transition. Familiar instances, showing the effect of heat upon such materials as compose strata, may be found in baked clays such as are used for pottery purposes. At this stage of his inquiry the student will do well to observe once again the action of the atmosphere and of rain upon the exposed portions of the rock. He will often find, that, when such rocks have been exposed to weathering, they have become somewhat porous. Pouring a little ink upon their surfaces, we find that it passes in between the interstices of the grains which are imperfectly detached. The same experiment tried upon freshly broken surface of rock taken from some depth beneath the part exposed to the atmosphere, will show how much more compact is the unweathered material. This softened rock has, in most cases, the character which the material had when it was first laid down by the agents which deposited it. That which has gone away by weathering was filled in between the original grains of sand and mud by the action of percolating water. When rocks originally porous, such as sand, are buried in the earth, the underground water is apt to convey into the interspaces between the grains a certain amount of stony matter, and to deposit it there and in this way the rocks become compact. Such processes of change do not require very much heat; but when the rocks have been exposed to heat by the penetration of dikes, or when they have been brought into great depths by the imposition of later-formed strata, the heated waters have a very great effect upon its structure. The tendency is, if the water is very hot, to take the whole mass to pieces, and to re-crystallize it. In this changed form it may present no likeness to its original shape.

The third question to be considered in the study of bed-rocks concerns the influence of pressure upon such deposits. Almost everywhere in this country the trained geological eye can perceive that the beds composing the earth's crust have been subjected to considerable dislocations. A little observation shows even the untrained person that the rocks are dislocated, and that the disturbances have

been effected by a pressure acting from the sides, and tending to bend them into arches or to break them into fragments, shoving the separated masses over the other. The simplest evidence of this compressive movement is found in the arching of the beds in the form of folds.

The student may assume that all deposits made on the sea-floor were originally in a nearly horizontal attitude. When he finds the strata cast into arches, he may be sure that the position has been given them after they were formed. In observing these features produced by the dislocative forces, the student must begin by carefully ascertaining the dip of the rocks, or the extent in degrees to which they depart from a horizontal attitude. Putting his observations on his map, and carefully recording them in his notes, he will soon accumulate data enough to enable him to determine the shape of these dislocations. When he has well advanced in these observations, he may begin to draw diagramatic cross-sections extending over the field of his map, and showing the attitudes in which the rocks lie. If the disturbances have been great, they have led to the formation of mountains; but it often happens, that, even where these mountainous folds are well developed in the under-earth, they fail to exhibit themselves by prominences on the surface. The reason for this is, that the original ridges or mountains have been worn down to their roots by the vigorous forces which operate upon the earth's surface, — frost, glaciers, streams, or the waves of the sea.

It will rarely be the case that these dislocations have taken place by simple folding; for, when the rocks begin to fold, they in most cases break or fault, and then the great wedges of strata are much shoved about, rising or falling out of their original position in relation to the other parts of the beds. The interpretation of such faults is difficult. It calls for a vigorous use of the geometric sense, or that part of the imagination which takes cognizance of form. At first the student will be puzzled by such phenomena, but gradually he will be able to unravel most of the problems produced by faulting action.

[Original in *Science News*.]

WEATHER LUNACIES.

BY FREDERIC A. FERNALD.

BEFORE celestial phenomena came to be well understood, the less familiar ones were generally interpreted as messages from superior Powers, foretelling good or ill fortune to mortals. The damage done to crops, houses, and ships by rains, snows, and gales, by freezing cold and scorching heat, as well as the favorable effects of smiling skies and gentle breezes, being so important, many of these supposed messages were taken as referring to the weather. Moreover, since some appearances in the sky — as clouds — really indicated weather-changes, ignorant people might perhaps be pardoned for supposing that various aspects of the heavenly bodies were likewise connected with the weather. A belief that changes in the weather were caused or indicated by the moon, arose in very remote antiquity, and has been well perpetuated by the Anglo-Saxon branch of the human race, as current literature and common folk-lore abundantly prove. Among the lunar weather-proverbs current in the rural districts of England is one to the effect, that, if Christmas comes during a waxing moon, the coming year will be a very good year, and the nearer to the new moon the better; but if during a waning moon, it will be a hard year, and the worse the nearer the end of the moon. Of equal value is the saying, "So many days old the moon is on Michaelmas Day, so many floods after." The notion that the day of the week on which a change of the moon chances to fall affects the coming weather, is quite widespread. Thus, in Worcestershire County, England, it is said, —

"If the moon on a Saturday be new or full,
There always *was* rain, and there always *will*."

Twenty one days is the term of foul weather expected in fulfilment of this prophecy. It is stated in an English book of folk-lore, published some thirty-five years ago, that "Dr. Forster of Bruges, well known as a meteorologist, declares, that by the journal kept by his grandfather, father, and self, ever since 1767 to the present time, whenever the new moon has fallen on a *Saturday*, the following *twenty days* have been wet and windy, in nineteen cases out of twenty." But this verification itself needs verifying. That a new moon on Saturday cannot come too seldom, is the idea in another maxim, heard in some places: —

"A Saturday moon,
If it comes once in seven years,
Comes once too soon."

Sunday is reckoned an unfortunate day for a full moon. In Norfolk it is said: —

"Saturday's new, and Sunday's full,
Never was good, and never will."

Or, what is apparently an older version, —

"A Saturday's change, and a Sunday's prime,
Was nivver a good mune in nae man's time."

In the south of France, Friday is the unlucky day for a new moon; and in the north of Italy, Wednesday. It is also said in parts of Italy, "If the moon change on a Sunday, there will be a flood before the month is out." New moon on Monday, or moon-day, is everywhere deemed a sign of good weather and good luck.

The country-people of Scotland are in the habit of forming prognostications concerning the weather for the coming month, from the appearance of the new moon. If she "lies sair on her back," — that is, with both extremities pointing towards the zenith, — a stormy month is expected. How much this sign is worth, may be inferred from the fact that in other parts of Great Britain, and in this country, the same position of the new moon is just as confidently held to indicate not foul but fair weather. Concerning this notion Southey wrote, in a letter from Keswick, in 1828, as follows: "Poor Littledale has this day explained the cause of our late rains, which have prevailed for the last six weeks, by a theory which will probably be as new to you as it is to me. 'I have observed,' he says, 'that when the moon is turned upward, we have fine weather after it; but if it is turned down, then we have a wet season: and the reason, I think, is, that when it is turned down, it holds no water, like a basin, you know, and then down it all comes.' There! it will be a long while before the march of intellect shall produce a theory as original as this, which I find, upon inquiry, to be the popular opinion here." George Eliot has used this bit of weather-lore in describing the burial of "poor old Thias Bede." "They'll ha' putten Thias Bede i' the ground afore ye get to the churchyard," said old Martin, as his son came up. "It 'ud ha' been better luck if they'd ha' buried him i' the forenoon, when the rain was fallin'; there's no likelihoods of a drop now, an' the moon lies like a boat there, dost see? That's a sure sign o' fair weather; there's a many as is false, but that's sure." This old weather-saw was doubtless brought to America by our forefathers, but it also appears here in a form which would imply a local origin. It is told as an Indian saying, that, if the horn of the new moon turns up enough to hang a powder-horn on it, the ensuing month will be dry.

But why *does* the position of the new moon's horns vary? Mr. Proctor, in his book on *The Moon*, has taken pains to answer this question fully, in order to despatch, if possible, the aged error mentioned above. The line joining the cusps, or horns, of the new moon, is always at right angles to a great circle passing through the sun and moon, and therefore *nearly* at right angles to the ecliptic. Now, the ecliptic makes very different angles with the horizon from time to time, and so the position of the line joining the moon's cusps must vary with respect to the horizon. Somewhat before the vernal equinox, in our latitudes, that part of the ecliptic near the western horizon soon after sunset is inclined to the horizon at nearly the greatest possible angle, or about 62°. If the moon happens to be at its greatest distance north of the ecliptic, about 5°, it may, soon after sunset, when very young, have the line joining its cusps but slightly inclined to the horizon, or even horizontal; or the "upper," or northern, cusp may be even lower than the southern. The old waning moon, before sunrise, soon after the autumn equinox, will be in like position. On the other hand, shortly before the autumn equinox the western part of the ecliptic is least inclined to the horizon soon after sunset, or about 15° in our latitudes. Then, if the moon is 5° south of the ecliptic, the line joining the cusps may be nearly upright. The same is true of the old waning moon before sunrise, soon after the vernal equinox. Thus, the line joining the moon's cusps may have any position, from nearly vertical to horizontal; and the northern cusp may be even lower than the southern, according to the season of the year and the moon's place in its orbit. "To assert," continues Mr. Proctor, "that there will be such and such weather when the line joining the cusps is seen (for instance) nearly horizontal, the moon being new, is the same as asserting that there must be such and such weather at the time of new moon in February and March, if the moon is then nearly at her maximum distance from the ecliptic. And so with all such cases. If there were any value at all in such predictions, they would imply the strictly cyclic return of such and such weather."

During a long storm, persons who are well versed in weather-lore are often heard to console themselves with the prediction that there will be a change of weather when the moon changes. Nasmyth and Carpenter characterize as a popular error, in its most absurd form, this belief that the gradual turning of the moon's face towards and away from the sun, could, at certain points, upset the existing condition of our atmosphere, generate clouds, and pour down rains. In England (and the same may be said of much of America) the weather changes about every three days, and there is a change of the moon every seven days, so that many coincidences must occur. Those who believe that "the moon rules the weather," always credit such coincidences to lunar influence. But the theory is untenable unless it applies to every case, and unless the same effect is always produced by the same cause. To suppose that a change of the moon will turn dry weather to wet, or wet to dry, indiscriminately, is the merest childishness, and contrary to all meteorological records.

Since the moon causes so great a movement in the waters of our globe, the idea has been advanced, that it produces also tidal action in our atmosphere, and thereby controls the weather. This action has been sought for, and is found to be measured by a four hundredth of an inch in the height of the barometer, — a quantity whose influence on the weather is completely masked by the greater effects due to other causes.

(Concluded next month.)

Practical Chemistry and the Arts.

[Original in *Science News.*]

THE DISTRIBUTION OF ARSENIC.

BY HENRY CARMICHAEL, PH.D.

The element arsenic, rare in a free state, is, in combination with oxygen, almost universally distributed. The oxide, or white arsenic, is the commonly recognized poison; but other compounds for the most part undergo decomposition in the body, and produce the same results.

At least in small quantities, it may be found in the soil, in rock deposits, and frequently in spring-water. Some chemists have affirmed it to exist, normally, in the tissues of animals and plants. It exists in iron and zinc, and from these it is known to find its way to the atmosphere of the house, where certain gas-generators are employed. The gas generated by the action of acid, and afterwards carburetted, carries with it the arsenic, which is liberated as arsenious oxide in the flame. Leading commercial reagents frequently contain it, and from these it may enter baking-powders and medicinal substances in common use. Hides are submitted to its action, and it may be retained in the leather. As a preventive of mould, it is a common ingredient of ink, mucilage, and the like. In the house, under various names it may be stored in careless quantity, to subdue the hardy potato beetle and predaceous vermin, or is scattered upon furs and clothing for their preservation. It is an occasional ingredient of cosmetics, and, as Fowler's solution, is a leading medicinal agent.

In the dyeing of calicoes and other fabrics, and in the manufacture of artificial coloring-matters, particularly of the brilliant coal-tar colors, arsenic is a useful if not indispensable agent; and, naturally, much of it remains in the finished products.

It is very easy for one skilled in chemical manipulation to discover arsenic; the most simple method being, to drench the suspected article with pure, strong, chlorhydric acid, and then introduce into the boiling acid a small strip of pure, clean copper, when, if arsenic is present, a peculiar steel-gray film is formed upon it.

It is surprising, to any one who has not used this test in its most delicate form, to note the prevalence of arsenic in textile fabrics and wall-papers.

Except the subject of the experiment be taken from specimens which manufacturers have, in deference to aroused public sentiment, made from selected materials, it will be rare, indeed, if it is proved entirely free from it.

What is the effect of arsenic thus widely disseminated in the products of nature and of art?

The fact that two grains or over of arsenic administered in a single dose is sufficient to produce death, is not pertinent to the discussion, inasmuch as, in accordance with the analogy of other substances, small amounts may be wholly beneficial when larger would be destructive.

Arsenic does not rank, like lead, as an accumulative poison, and may in a short time be wholly eliminated from the system, without leaving a trace of its action.

A glance at the literature of the subject shows, on the one hand, that the victims of the arsenical habit acquire an extraordinary tolerance of the drug, and, on the other, reveals a long array of victims from the exposure, as is alleged, to arsenic given off by wall-paper.

In a typical case of poisoning, the patient is restless, pallid, unable to sleep, and suffers from weak eyes, gastric troubles, and nervous prostration. The physician suspects that the paper is the cause, and orders an analysis; arsenic is discovered, the paper is removed, and the patient gets well. Before accepting here the relationship between cause and effect, it is well to remember our proneness to attribute our illness or our recovery to the agency which the popular notion of the hour indicates, — a fact which flourishing quackery abundantly proves.

The art of diagnosis has not become so exact a science as to dispense with the verification of the laboratory, and it is just here where the medical theories of the case fail of proper support. The transmission of the poison has not been demonstrated.

It is conceivable that arsenical pigments imprinted as a fluffy powder upon the surface, may be transported by air-currents, and find lodgment in the respiratory passages; but, although the experiment has been often tried with smooth papers, we are not aware that the loss of arsenic from the paper, or the existence of arsenic in the air, has been demonstrated.

As the arsenical pigments are not volatile, it is again conceivable that by the putrefaction of the paste, arseniuretted hydrogen, an extremely diffusive substance, may be given off.

The older experiments that seemed to give countenance to this theory have failed in securing general confirmation. Chemists have detected arsenic in the urine of persons occupying rooms papered with the ordinary arsenical article; but until it can be shown with a reasonable degree of certainty that paper thus situated is actually losing arsenic, or until it is found in the air as well as in the urine, it is easier to account for the discovery in other ways; and the terror which a few grains of arsenic upon the walls have been made to excite in many homes is not justified by the facts produced.

The occasional local disturbances caused by underwear containing arsenic, offer more convincing proof of poisonous action; and while the writer is not willing to exaggerate the perils to which the young especially are exposed, by toys, confections, papers, clothing, and many things charged with arsenic, there certainly appear to him grounds for the legislative control of arsenical substances, that the quantity scattered in the community may be reduced to such a minimum that acute poisoning may be prevented, and chronic poisoning rendered impossible, in view of new experiments which should be made to settle the present conflicting views.

55 Kilby Street, Boston.

HOW TO MAKE A POCKET ACCUMULATOR.

The following method of making a pocket accumulator is given in the *Magazine of the Finsbury Technical College* (England): —

"There are several kinds of pocket accumulators in existence. There is the thick one, whose box is made of ebonite, the thin one made with lead casing, and the thin one made of ebonite. Of these, the last is the most convenient and portable. The ebonite box, with the accompanying top, may be obtained very cheaply. The boxes are made with a partition down the middle, to form two cells. The first step is either to shellac, varnish, or cover with elastic glue, the edges of the partition, to make it water-tight; the next is to make the plates. The simplest plan is to get a plate of lead about one-twelfth of an inch thick, and cut it up into six strips just broad enough (say, one inch) to go into the cells, three in each, side by side; the usual length for these strips, about three inches, depending on circumstances. Each of these strips should be made with a lug at one end to project outside the cell. The top of ebonite is then divided into two, and each half carefully fitted into the inside of each cell. Each half then has three holes cut in it for the lugs to come through, and a hole through which to pour the acid into the cells. The six strips are then placed in position, three in each cell, with two india-rubber bands passed round the middle strip of each cell; the band should go round vertically, not horizontally. This will be sufficient to insulate them from each other. A band may be placed round all three, if preferred, to steady them, but is not necessary. The tops are then put in, and glued in carefully; taking great care that no hole is left where leakage might occur, either from one cell into the other, or from the cells to outside. There are then six lugs of lead projecting out from this, — three in one half, and three in the other. The two outer lugs of one cell are then joined to the inner lug of the other cell; the inner lug of the first cell is fixed into a binding-screw, which is then vertically fixed into that end of the top; and the two outer lugs of the second are fixed to another binding screw, which is then fixed in a similar manner to the former in the other half of the top. A small glass tube, about three-fourths of an inch long, is then placed in each of the two remaining holes. A layer of glue is then put all over this, so that the only parts projecting are the binding-screws and the tops of the two glass tubes. The binding-screw, which is connected with the centre plate of the first cell, is then marked +, and the other —, as the centre plates in each cell will be the + plates. Acid is then run into the cells, the proportion of acid to water being one in six. The cells are then charged, discharged, and reversed, a large number of times, till fit for use. When used in the pocket, the glass tubes should be closed with gutta-percha stoppers. The accumulator may be used before the plates are fully formed; but the forming process should continue till the plates have a capacity of about two ampère hours. The E.M.F. of these cells is four volts. It is advisable to make a case of some sort for the accumulator, in case there should be any slight leakage of acid, which would otherwise have disastrous consequences on the wearer's clothes. Of course, these cells will not stand much rough treatment, but must be used carefully."

[Original in *Science News.*]

RIFLE BARRELS.

BY EDWARD P. ROCHE, M.D.

THE equipment of the modern soldier grows more expensive year by year, in spite of machinery and improvements in arms. Undoubtedly the most important weapon is the rifle, and the most essential part of that, so far as accuracy is demanded, is the barrel. No matter how fine the workmanship, if the inside of the barrel be crooked, the weapon is uncertain, and the soldier using it placed at so great a disadvantage as to be liable to defeat from a smaller force better armed. Notwithstanding the close and minute attention given to all parts of the soldiers' equipment, I can recall no change in the inspection, from the days of Knoxville and Petersburg to the present, designed to detect errors in the straightness of the rifle barrel; so long as it is clean and bright, its ability to "shoot around a corner" passes unchallenged.

Few are aware how easily the barrel of a rifle can be sprung by careless usage, such as carrying knapsacks slung across it, or sticking it into the earth by the bayonet. I once, at a field hospital in Virginia, examined several Springfield rifles left by the wounded, and nearly every one was bent in the stock, so that the muzzle pointed upwards. As a consequence, when fired, the shot must have gone high.

The last finishing touch given to the barrel before rifling is to straighten it. This is done by reflecting the image of a straight line into the bore of the barrel; and, if the reflected line appears crooked, the barrel *is* crooked, and is straightened accordingly.

The reflection of the line for purposes of straightening necessitates a true cylinder: hence it is done before rifling; the grooves of the rifling, by breaking the continuity of the reflected line, preventing any thing but an approximate straightening after they are cut in the barrel.

Some years ago the following plan to overcome the difficulty occurred to me; and, never having seen any thing of the kind in print, I offer it to the readers of the *Science News*. It may have uses beyond rifle barrels.

I would propose, that, after the barrel has been finally straightened, three fine lines, cut with a diamond-point tool, be made the entire length of the barrel, on the outside, and at about equal distances on the circumference. Now, if the barrel is bent in any direction, one of these lines must also be bent, and serve as a tell-tale.

As the outside of the barrel is not a true taper, the following device may be useful. It consists of a mirror, on which is cut a true straight line. Opposite the mirror is a stand for the barrel; by turning the barrel in the stand, the tell-tale line can be reflected alongside the standard one on the mirror, and any damaging deviation noted.

Of course, all this is not for the Sunday inspection; but the army has surgeons, farriers, veterinary surgeons, engineers, and ordnance officers: why not a skilled inspector of arms?

REMARKABLE SPECIFIC GRAVITY OF LIME-WATER.

I HAVE recently had occasion to take the specific gravity of lime-water, and have noted a peculiarity which appears to me to be of very great interest. According to a recent determination in my laboratory, a liter of lime-water contains 1.344 grams of CaO, and the specific gravity of the lime-water reaches the extraordinary figure 1002.35, compared with distilled water at the same temperature, reckoned as 1000.00 (the temperature was 13° C.).

It follows from these observations, that in the formation of lime-water a most extraordinary contraction takes place.

Before solution, —

CaO	0.5 c.c.	=	1.344 grams,
H_2O	1001.0 "	=	1001.0 "

which contract so as to occupy one litre.

The contraction is, therefore, three times the volume of the lime which dissolves in the water and forms lime-water.

The purity of the lime-water was ascertained by exactly precipitating the lime by means of its equivalent of oxalic acid, filtering, and evaporating the filtrate to dryness; the residne was so small as to be insignificant. — J. A. WANKLYN, *in Chemical News.*

A SIMPLE SULPHURETTED HYDROGEN APPARATUS.

Materials. — *A*, a large test-tube 5 inches long, 1 inch diameter, to be wrapped with thread so that the cork can be tightly inserted; *B*, a test-tube 9 inches long, ½ inch in diameter, the bottom slightly drawn out, and having a hole drilled through it; *C*, a good sound cork with two holes bored through it; *D*, lumps of ferrous sulphide; *E*, asbestos; *F*, a small tube connected by rubber tube, *G*, to *H*, a small glass tube drawn nearly to a point.

Operation. — Insert tube *B* so that the opening is near the bottom of the tube *A*. Asbestos is then placed loosely about the end of *B* to keep the ferrous sulphide, which is then placed in, a short distance above the end of *B*. The cork *C* (which has been near the top of *B*) is now shoved down into position. If the dilute H_2SO_4 is now poured in *B* until the ferrous sulphide is covered, the apparatus is ready. The cork *I* should now be inserted; and as H_2S is generated, it escapes through *F*. After the gas has been formed, the action may be stopped by removing cork *I*, and pinching together rubber tube *G*. The gas, having no outlet, forces the liquid up into *B*, and the action ceases. Now insert *I*, and the acid remains in *B* until the apparatus is again required for use.

H. A. E.

[The lettering in the engraving is, unfortunately, rather indistinct; but we think the construction of the apparatus is made sufficiently clear by the text. — EDS.]

CHEAP MANUFACTURE OF SODIUM AND POTASSIUM.

CASTNER'S new process, by which the cost of production of these metals is considerably cheapened, consists in reducing the alkaline hydroxide, or carbonate, when melted at a moderate temperature, by causing a metallic carbide, or its equivalent, to react upon it, thus dispensing with the large quantity of carbon and with the lime now employed. The reducing agent employed remains below the surface of the alkaline bath, and is consequently kept in constant and direct contact with the melted alkali. It is formed by coking an intimate mixture of tar and iron, the latter in a fine state of division, as obtained by the action of hydrogen. For each kilo. of pure caustic soda, there are required twenty-two kilos. of this iron carbide. The operation is effected in large cast-iron crucibles. The yield may reach ninety per cent. This process will doubtless have an important effect upon the price of aluminium.

LABORATORY NOTES.

FILTERS. — By soaking the edge of a filter with paraffine, wax, or fat (free from ash), the tendency which some precipitates have to creep over the edge is entirely removed.

SEPARATION OF ARSENIC AND ANTIMONY. — Zambelli and Luzzato recommend peroxide of hydrogen as a means of separating antimony from arsenic. The precipitated sulphides, still in a moist condition, are treated with the peroxide in excess at a temperature of 40° C. (104° F.) for some hours; the mixture then heated to boiling, and filtered. The arsenic is converted into soluble arsenic acid, the antimony into insoluble oxide.

NEW MODE OF PREPARING OXYGEN. — Into a suitable generating apparatus introduce two pints of commercial solution of peroxide of hydrogen (3 per cent) and a pound of dilute sulphuric acid (1.5). Into this mixture allow to enter carefully and gradually, through a safety funnel, a solution of 800 grains of potassium permanganate in 28 fluid ounces of water. Oxygen will be rapidly disengaged without application of heat, the yield from the above quantity of materials being five gallons.

FILTER FUNNELS. — An improvement in filter funnels is claimed to have been realized by W. C. Nickels. He constructs them double, with a space between the two cones; the inner one, on which the paper rests, being perforated with small holes, so as to allow the free escape of the liquid over the entire surface. A slight vacuum may be also maintained in the space between the two cones, by well-known artificial means, which, of course, greatly facilitates the filtering process, without injury to the paper.

SIMPLE ARRANGEMENT FOR REVERSE FILTRATION. — The neck of an ordinary vial is cut off. The outer end is ground on a lead, copper, or wooden surface with emery and water. Into the other end a one-hole rubber stopper is inserted, and pushed in so as to be flush with the opposite end. On the last-mentioned end a perforated platinum disk and a disk of moistened filter-paper are placed. Into the hole of the rubber stopper a tube is inserted, which is itself connected with the aspirator.

LABEL PASTE. — A writer in the *Scientific Enquirer* recommends the following preparation of gum-tragacanth as the best for sticking labels to glass: "Select three or four pieces of the gum about the size of a coffee-berry, and place in a two-ounce, wide-mouthed bottle; then pour over it acetic acid so as to barely cover the gum, and place the bottle aside until the next day, by which time the gum will have absorbed the fluid, and become very much swollen. Now add water, stir well, and in a day or two a semi-transparent jelly will be the result. A drop or two of ninety-five per cent solution of the best carbolic acid should then be added, and it will keep indefinitely."

HOW TO CUT A BOTTLE. — A correspondent of the *Chem. and Drugg.*, in describing how to make a percolator, mentions the following method of cutting a bottle: "I was first shown how to do it by an ingenious mechanic, and have since seen the same published in Spons' 'Workshop Receipts.' Put the bottle on a level foundation, and fill up with oil as far as you wish the line of separation to be Next get a rod of iron as large as possible, but small enough to go into the mouth of the bottle. Make the iron almost white-hot, and dip it into the oil. In a very short time a crack will be heard, when the iron can be taken out, and the bottle will be found as neatly cut as if with a diamond. Should the bottle be very thick, and the crack not heard in a minute or so, a dash of cold water outside will settle the business."

Home, Farm, and Garden.

THE BUFFALO CARPET BEETLE.

This troublesome insect has commenced his annual raid upon carpets and clothing; and, in answer to many requests from subscribers, we copy from *Good Housekeeping* the following facts, a part of which were first published in the report of the Massachusetts Agricultural College. We can hardly indorse the suggestion to destroy them by means of gasoline, as the inflammable and explosive nature of its vapor renders it a very dangerous article to use in a house; but, if it *is* used, the greatest care should be taken that there is no fire or light within a long distance.

Although this insect has been known in Europe for more than a hundred years, it was not reported in this country until 1850, when Dr. LeConte found a variety of it on flowers in California. Dr. LeConte suggested that it might have been imported into California from Southern Europe during the Spanish occupation of that country. Professor Lintner says the name "buffalo-bug" was given to it on the Pacific coast, probably because of the fancied resemblance of the larva to the buffalo.

In the Eastern States they are reported to have been first discovered in 1872, in Buffalo, N.Y., and very soon after in Massachusetts. Dr. Hagen learned, upon inquiry, that many of the infested carpets in and around Boston came from one large carpet store in that city; and it is therefore very probable that they were brought from Europe in imported carpets. It has frequently been reported that this insect does not confine itself to woollen fabrics, but also attacks cottou and silk. This, I think, must be a mistake, says the writer, for those which I have been breeding during the past year have refused to eat cotton or silk; and, when supplied with mixed goods, they ate out the fibres of wool, leaving the cotton and silk intact.

The perfect beetle is ovate and moderately convex. The head is black, with a few orange-red scales around the eyes and above the mouth. The antennæ are black, eleven-jointed, terminated by a broadly oval three-jointed club, which is as long as all the preceding joints united. The thorax is black, with the sides and base more or less covered with orange scales. The wing-covers are black; but the suture is broadly red, with three equidistant lateral projections of the same color, the first two of which join sinuous, white, imperfectly defined bands. The posterior is obscurely connected with a red spot at the end of the wing-cover, and there is usually a small white spot at the base. The under side of the body is black, more or less covered with red and white scales. Length, from one-seventh to one-eleventh of an inch. The colors are subject to considerable variation. The red band along the middle of the back is sometimes replaced by white; and the first two bands of white on the wing-covers are run together, forming one broad white band.

These insects attack the exposed edges of the carpets; and wherever they can make their way underneath, especially along the cracks of the floor, they often divide the carpet as neatly as it can be done with a pair of scissors. They are, undoubtedly, very difficult insects to exterminate; for the ordinary applications of camphor, pepper, tobacco, turpentine, carbolic acid, etc., produce no effect on them. Benzine or kerosene oil used freely in all the cracks and crevices of the floor will destroy them in all their stages if brought in contact with them; and the odor of benzine, if sufficiently strong, will kill the larvæ and perfect beetles. Tarred paper under the carpets, napthaline, gasoline, and bisulphide of carbon have all been recommended; but their disagreeable odor and the explosive properties of the last two render them undesirable. When furniture is infested, it should be removed to an out-building, where there is no fire, and thoroughly treated with benzine or gasoline. The furniture should not be returned to the house till the liquid has entirely evaporated, and there is no odor.

One of the best remedies for infested carpets is, to spread a wet cloth along the edge, or over any part where the pests are supposed to be at work, and run a hot flatiron over it, so that the hot steam, penetrating through the carpet, may destroy them. This work must be very thoroughly and carefully done to insure success. When woollen garments are put away for the summer, they should be packed in tight boxes, with paper pasted over every crack where one of these minute insects could possibly gain an entrance. If there is any danger that these garments are infested before packing them away, they should first be treated with benzine.

Among the insects sent me as carpet beetles, none have been received more frequently than the two-spotted lady-bird, which is perfectly harmless. The perfect beetle is about one-fourth of an inch long, and nearly hemispherical in form. The wing-covers are red, with a black spot on the middle of each. The thorax is white, with a black stripe on each side of the middle; and these are joined by a prolongation obliquely backward from the middle of each. The head is black, with a white spot on each side in front of the eye; and the under side of the body is black.

[Original in *Science News.*]

THE MYSTERIES OF PLANT-GROWTH.

BY FRANCIS WYATT, PH.D.

V.

In the course of the reactions which go on in the interior of plant organisms during the processes of vegetation, are any compounds produced which entail or permit of a direct combination with nitrogen from the atmosphere?

This topic has been, perhaps more than any other, the object of controversy and discussion, and is consequently well worthy of attentive study.

The methods adopted by Boussingault, who first attempted to discover whether vegetables assimilated this gas from the air, was that of planting in sterile soils, from which all organic matters had been carefully excluded; the composition of the seed, especially with regard to its proportion of nitrogen, having been previously ascertained by careful analysis. A certain time was allowed for the full development of vegetation; and a new analysis was then made, not only of the plant itself, but also of the soil, and the vase in which it had been grown. A balance was established between the proportion of nitrogen found in all three aud that which first existed in the seed, and any increase which had taken place was considered to be owing to atmospheric absorption.

Clover and peas were both shown, by this first attempt, to have acquired a large increase of nitrogen; whereas wheat gave no evidence of any gain, the same quantity being found in the crop as had been determined in the seed. The leguminous species, therefore, appeared to have somehow derived, from somewhere, a certain quantity of nitrogeu; but there was nothing to indicate in what shape it had been absorbed, and no proof that its presence did not arise from assimilation of the ammoniacal vapors abounding in the air.

The results thus summarily stated gave rise to so much doubt and discussion, that the same author, in 1851, consented to renew his experiments.

In this instance, however, he conducted them in closed apparatus, which, while allowing access to carbonic acid, and water devoid of ammonia, successfully excluded the entry of any of those ammoniacal vapors, and of that organic dust known to exist in the air. No normal development of the plants took place; their weight being seldom found to exceed double, and never more than quadruple, that of the seeds employed. The species grown were beans, lupines, oats, and cress, and no absorption of any atmospheric nitrogen could be detected.

The performance of these experiments was the signal for hosts of others, undertaken by different scientists with various more or less ingenious mechanical appliances, in some of which a free current of natural gas was allowed to circulate; but the same effect was invariably obtained.

The extreme care, the elaborately minute exactitude, with which all these trials are described, seems to have conveyed a legitimate and reasonable conviction that they were conclusive; and it was only when George Ville claimed to have obtained opposite results by the employment of virtually the same processes, that the public mind allowed itself to be again disturbed.

This remarkable chemist, while admitting that the inferences drawn from the last experiments made by Boussingault were perfectly justifiable so far as concerns vegetation in a completely sterile soil, maintains that their inexactitude is absolute, as representing what would take place in an ordinary soil already contaiuing some nitrogenous matters.

He says, "Plants do not acquire the property of absorbing gaseous nitrogen from the atmosphere until they are already in a vigorous state of growth, and this growth they can only attain by finding in the soil the nitrogenous elements necessary to their first development.

"If the extremely small seeds of tobacco or colza are sown in a sterile soil, the vegetation will be feeble and unhealthy, and no absorption of atmospheric nitrogen will take place; but if these sterile soils are first treated to an application of nitrates in appreciable quantities, the resulting plants will be found not only to weigh three hundred, and even up to seven hundred, times the weight of their seeds, but will contain considerable quantities of nitrogen, which can only originate in the surrounding air.

"All vegetables are not equally apt to seize and appropriate the precious element from the atmosphere; the leguminous species, for example, being found to afford as good a crop when manured with phosphoric acid and potash alone, as they produce when what is called complete manures have been employed."

To some of my readers these assertions may have a startling sound: but we must remember that the actual experiments of Ville himself at Vincennes, those of Lawes, Gilbert, and Pugh at Rothamstead, and, in fact, the whole course of practical agriculture, have all satisfactorily shown, that, in the cultivation of wheat, complete manures will increase the crops at least twofold; whereas, with peas, beans, and clover, there is no appreciable difference, whether the manure employed be a complete or merely a mineral oue.

It is, in a word, traditional among farmers, that a crop of wheat is always better when it follows a crop of clover; and we need not go far for an explanation if we admit that the greater portion of the nitrogenous principle left by clover on the soil, in its stalks aud rootlets, has, in some way or other, been derived from the air.

The names of Boussingault and George Ville are rightly placed in line with the foremost and best of European agricultural scientists; and both, as all the world knows, have devoted an immense amount of studious care and time to investigating my present subject.

In one of his most exhaustive essays on the action of nitrates in the vegetable economy, Ville reminds us that during the decomposition of organic matter, nitrogen is evolved; partly in a free state, and partly as ammonia gas. Basing his arguments upon this phenomenon, he tries to find in Boussingault's writings and experiments a full confirmation of his own views.

He particularly refers to one of the numerous experiments made by his illustrious antagonist, in which three lupine seeds sown in burnt sand were manured with six seeds of white lupine, deprived of their germinative faculty by immersion in boiling water. These three plants were found to grow much better than a similar quantity sown at the same time in pure sand, and their crop showed a considerable increase of nitrogen over that contained in their seed; it being, however, subsequently discovered that more had been lost by the manure than the three plants had absorbed.

"If," says Ville, "it could be shown that all the nitrogen evolved by the organic manure was in the form of ammonia, Boussingault's conclusions would be incontrovertible; but a large proportion must necessarily have been in a free state, inasmuch as what was given off as ammonia would not account for the total nitrogen found in the crop."

Now, if Ville's arguments were absolute, they would end the controversy in favor of the gaseous absorption theory; but I must confess that I am far from convinced by them, and have several times objected to his conclusions. For justification of my objections I rely upon the chemical fact, that, under the influence of both nascent oxygen and ozonized oxygen, nitrogen invariably enters into combination, and forms nitrates. With our present advanced knowledge of the manner in which this nitrification takes place, I am led to believe that in each of these experiments nitric acid was formed, which would have furnished the nitrogen found in the plants, and which neither pre-existed in the seed nor in the fertilizer.

With a readiness and resource which have ever characterized his arguments, Ville has replied, stating, *that, in his personal experiences, he has never remarked the formation of nitrates*, despite the care with which he has sought for them, and draws from general practical agriculture fresh proofs to maintain his ground.

He calculates, for example, the quantity of nitrogen existing in a given crop, and at the same time determines the different bases found in the ashes not saturated by the acids the crop contains. He takes it for granted that these bases were introduced into the tissues as combined salts, and, by deducting from their total weight the necessary fraction to saturate the acids, finds that a quantity still remains, *which might have entered as nitrates!* and hence admits that it would *prima facie* appear as if no free nitrogen had been absorbed.

He, however, explains that the quantity of this element found in the crop itself was larger than that contained in the fertilizer, and too great to have been absorbed entirely as nitrates; and therefore, while granting that all the bases found in the ash, not saturated by the weighed acids, may have entered as nitrates, he yet maintains that there would still be an excess of organic nitrogen, which must have been taken from the air! This is, no doubt, very forcible reasoning; but Mr. Ville has not explained, as he might do, why nothing was done to show that the excess of nitrogen was not absorbed as an ammoniacal salt, which, unlike the nitrates, would have left no trace of its entry!

It seems a great pity that the rival theories of absorption and non-absorption should each be so plausible, and that they should each be sustained and defended by scientific authorities of the first water. On the one side, it is positively affirmed that experiments prove plants to be incapable of absorbing their nitrogen from the air; while, on the other side, it is claimed with equal firmness, backed by the same amount of experiment, that the unquestioned excess of nitrogen found in the crops of a cultivated soil, over that introduced in the form of manure, cannot be traced to any other source.

Some fifteen years ago it was discovered that ammonia underwent dissociation when passed through a platinum sponge in a current of air, the combustion of its two elements causing the sponge to become incandescent; and it then appeared feasible to suppose that in the soil the various porous bodies there contained would induce a similar reaction in a milder form. This theory was, however, upset by Boussingault, who, while he failed to produce any result from a mechanical mixture of ammoniacal substances with sand and chalk, observed, that, when the same mixture was introduced into a cultivated soil, nitrification at once took place.

This experiment, confirmed by more recent investigators, teaches us that this special action is peculiar to the soil, and must be induced by fermenting micro-organisms; for, while it may be stopped in a particular soil, either by raising the temperature to about 240° F., or by the influence of chloroform vapors, it may be perfectly restored by mixing in fresh quantities of any kind of other soil in which vegetation is going on. The activity of these germs necessarily varies with the amount of ammonia present, and with the different degrees of temperature and moisture; while, being atmospheric microbes, their propagation is increased by ploughing or harrowing the land.

Hence a well manipulated — warm and calcareous — soil, accessible both to air and water, frequently produces so much more nitrates than are necessary for the growing crops, that a large quantity sinks down into the subsoil, and is carried off by the under drainings.

In the course of the Rothamstead experiments, it is interesting to observe that copious nitrification has constantly gone on (as shown by analyzing the field drainings) equally well when the nitrogen was administered in the form of stable, or other animal or vegetable, manure, as when it was directly furnished in salts of ammonia; and although many scientific farmers have congratulated themselves upon this circumstance, because of its momentary advantages, I personally consider it to be a source of great future danger and difficulty.

Since the combustion of nitrogen can only take place simultaneously with a chemically regulated proportionate combustion of carbon, it naturally follows, that the greater the nitrification in a soil, the more rapid will be the exhaustion of its organic matter.

Now, we may certainly look upon this organic matter as the most precious of elements, for it plays the leading part in the functions of vegetation, by retaining humidity, and thus enabling plants to withstand long periods of drought. If, therefore, our lands are worked at too high a pressure, if due attention be not paid to a systematic and rational rotation of crops, if grasses and clovers are not periodically grown, the carbonaceous elements will be gradually burnt up, and we must inevitably arrive at a period of sterility which no amount of artificially introduced nitrogen will ever correct.

Reviewing all that I have written, and neglecting the somewhat premature and hypothetical conclusions lately arrived at by Berthelot in regard to the instrumentality of yet another form of lower organism in imparting to the soil the nitrogen of the air, it must be admitted, that, despite so much earnest work, very little progress has been made, and that there is still room for a great deal of discovery before existing uncertainties can be removed. As to my own opinions, they are already sufficiently well known, and have undergone no change since I declared, in *Modern High Farming* (chap. iii. p. 16), that I content myself for the present with the chemical phenomena of nitrification.

No one denies that nitrates are continually forming in the soil; and it may yet be proved that the nitrogen permeating the sap of the plant is brought into contact with the oxygen resulting from the decomposition of carbonic dioxide, and, thus forming nitric acid, is distributed throughout the tissues.

NEW-YORK CITY, *June*, 1887.

GLEANINGS.

CULTIVATING FROZEN SOIL. — The French Agricultural Society condemns the practice of ploughing or working over the soil in the early spring, when slightly frozen or covered with snow, as the temperature of the soil is reduced, and the process of germination retarded.

POISONOUS HONEY. — At a recent meeting of the Dresden Agricultural Society, a local druggist reported, that, in a neighborhood where the deadly nightshade grew abundantly, the bees had incorporated with the honey sufficient poison from these flowers to account for numerous and occasionally fatal cases of poisoning. He also stated that gelsemium had been detected in American honey.

COTTON is not a fibre, but a plant-hair. It holds to be spun into a thread because of peculiar twists in each hair, shown under the microscope, especially in polarized light. Linen thread may be spun because the flax fibres have certain roughnesses on their surfaces, which enable them to cling together. Hence it is impossible to make as fine linen as cotton cloth, but it is much stronger.

TO CURE A SHEEPSKIN WITH THE WOOL ON. — If the skin is dry, first soak it in soft water until pliable. Take a straight piece of an old scythe, a foot and a half or two feet long. Dull about four inches or six inches of each end; insert them in wooden handles, or wind them with cloth, so as not to injure the hands. Lay the skin upon a bench or inclined board, with the flesh side up, and remove all flesh and fat with the above instrument; also trim off the skirts or rough edges. Mix together pulverized alum, one pound; salt, a half-pound; wheat bran, one pint. Add sufficient water to make a thick paste, which spread over the flesh side of the skin as evenly as possible. Fold it, bringing the flesh side in; roll up closely and lay away, where it cannot freeze, for about four days; then unroll, brush off the paste, and work the skin with the hands until pliable. The skins of deer and calves, or fur-bearing animals generally, can be preserved in the same manner.

COCOANUTS. — Cocoanut-growers say that each tree in a grove produces one nut a day, or three hundred and sixty-five in one year. Owing to the great height of the trees, it is impossible to pick the nuts, and they are allowed to hang till they fall. The natives gather them up, and carry them to the husking machines, where the nuts are stripped of the thick outside shell. A nut is most delicious just after it has dropped from the tree.

The Popular Science News.

BOSTON, JULY 1, 1887.

JAMES R. NICHOLS, M.D.
WILLIAM J. ROLFE, A.M. } . . . . . Editors.
AUSTIN P. NICHOLS, S.B.

Subscribers owing for the present year will find bills for their subscription enclosed in the present number. Their prompt return, accompanied by the necessary amount, will be highly appreciated by the publishers.

Twenty-one years ago, on the 1st of July, 1866, the first number of the *Boston Journal of Chemistry and Pharmacy* was published. A few years ago the name was changed, for various reasons, to the *Popular Science News;* but it has always remained under the same editorial management, and is in every respect the same paper. The first number, now before us, comprises only seven pages of reading-matter, and contains articles describing the *new* substances, carbolic acid and nitro-glycerine, as well as a prediction that the third attempt to lay an Atlantic cable would be successful. Even in this comparatively short time so many important discoveries have been made, that many departments of science and art have been entirely revolutionized. As the *News* has now attained its majority, we trust that its sphere of usefulness will be correspondingly increased. During its adolescence; its growth has been constant and rapid, and we trust, that, in the years to come, it will continue to improve, and give increased satisfaction to its readers.

The total eclipse of the sun which occurs on the 19th of August is of unusual importance inasmuch as it is visible in civilized countries within easy reach of telegraphs and railroads. From Eastern Europe into Siberia a line of observers will be stationed, and it is not unreasonable to expect that much valuable information will be gained. The recent advances in astronomical photography will add very much to the facilities of the observers. Professor Young will be stationed at the town of Tver, near Moscow, and will send an account of the eclipse to the *Science News* at an early date. He will be accompanied by an assistant, a photographer, and a mechanician; and, if the weather is favorable, the results of the expedition will certainly be of the greatest interest.

A statement last month, in the article "Possibilities of the Future," seems to have been misunderstood by many of our readers, judging from the number of letters we have received. We did not intend to deny the practicability of electric motors in working short lines of railroad in localities where locomotives cannot be used, or where a large water-power is always available. The question is simply one of expense; and although it would certainly be impracticable to operate a long railroad line by any such method, there are many short lines now in operation where the greater cost of the electricity is counterbalanced by the safety and convenience of this method of applying power. We do not, however, believe that it will ever come into very general use, even for those city lines now operated by horses.

We take pleasure in publishing this month an article, by Professor W. G. Sumner of Yale College, upon a subject which is at present assuming great importance. Professor Sumner is one of the leading political economists in the country, and his views are worthy of the most careful consideration. We have heretofore devoted our columns to the natural and physical sciences only; but social and political problems are worthy of equal attention, and, when separated from mere partisan politics, form a true science in themselves.

Sulphate of lime is one of the few substances which are less soluble in hot than in cold water, and most authorities state that at high temperatures it becomes entirely insoluble. Mr. C. C. Peck has recently made some experiments on this point, and finds that up to 388° F. a notable amount of the substance still remains in solution. This observation, if confirmed, has an important practical bearing upon the matter of steam-boiler incrustations, as the water in many localities contains this substance in solution, and its removal is a matter of considerable difficulty.

ERRORS OF NOMENCLATURE.

In the early days of chemistry there was no definite system of nomenclature; but each discoverer of a new substance applied such names as his fancy dictated, or were suggested by some fanciful resemblance, which, in the light of modern knowledge, often seems ludicrously inappropriate.

Thus, oil of vitriol is not in any sense an oil; neither, strictly speaking, is oil of turpentine, or even kerosene. Copperas is a salt of iron, and contains no copper. Butter of tin or antimony only slightly resembles butter in appearance. Salts of lemon is the highly poisonous oxalic acid, and its unfortunate name has caused many fatal accidents. Carbolic acid is not an acid at all, but allied to the alcohols. What is sometimes known as cobalt does not contain any of that metal, but is metallic arsenic. Seidlitz powders have nothing to do with the waters of the famous mineral spring. Soda-water does not contain a particle of soda, nor sulphuric ether any sulphur.

Sugar of lead contains no sugar, nor has cream of tartar any thing to do with the lacteal secretion of the cow. The same may be said of milk of lime. The word "oxygen" means the acid-former; but, according to the new chemistry, not oxygen, but hydrogen, is the element indispensable to the composition of an acid. German-silver contains no silver, and black-lead no lead. Mosaic gold is a sulphide of tin, and has no gold in its composition, nor is it used in the manufacture of mosaics. Putty-powder, an oxide of tin, is not to be found in any ordinary kind of putty.

In other departments of science similar errors are not uncommon. The rocks of the azoic (no-life) age are now found to contain fossils. The mineral pyroxene occurs in igneous rocks; while its name, derived from the Greek, means "a stranger to fire." Platinum is from the Spanish, meaning "little silver," but, as is well known, has no relation to that metal. Réaumur's porcelain is not porcelain at all, but a peculiar kind of glass. Jerusalem artichokes are not artichokes, neither do they come from Jerusalem. The camelopard, or giraffe, has no relation to either of the animals from which his name is compounded. Shell-fish are not fish, but mollusks. The civet-cat is not a cat, and the sea-horse is very far removed from the land animal from which it takes its name.

This list might be extended indefinitely; but the examples given will show that names as well as appearances are deceitful, and that the nature of a thing cannot always be accurately predicated from its usual appellation.

To the unprofessional reader, certain names of organic chemical compounds might be considered as "errors of nomenclature. When a term like methylprotocatechuicaldehyde is necessary to describe the odoriferous principle of the vanilla-plant, it certainly seems as if it was a rather drawn-out appellation; but in this and similar cases the entire chemical relations of the substance are indicated to the chemist by such a term, and the number of organic compounds is so large that it would be impossible to find short and appropriate names for them all. When the compound, like the one referred to above, is of any practical use, a shorter one is easily devised, — vanillin being the common name in this case; but for the innumerable substances which are of interest only to the chemist, these polysyllabic atrocities are almost indispensable, and convey information regarding their nature which could be briefly stated in no other way.

OPTICAL ILLUSIONS.

In a lecture before the Franklin Institute, Mr. Charles F. Himes exhibited a diagram which presents a most remarkable illusion. If one looks at the rectangular solid represented in perspective in Fig. 1, the face *ABCD* will usually appear nearest to him, and *x* farthest away; but, by looking a little more closely, a slight effort of the will causes this appearance to be reversed, and *ABCD* seems to be the back face, while *x* comes to the front; the apparent position of the solid changing at the same time. A little practice will enable one to cause it to change sides at will; and a peculiar sensation is experienced as the figure apparently changes its position, as if endowed with life.

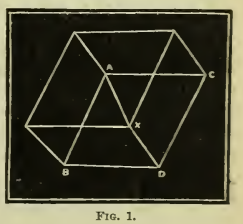

Fig. 1.

It is rather difficult to briefly explain this illusion, which depends upon the laws of perspective. When the face *ABCD* appears to be in front, the block appears to be resting in a natural position, and consequently the eye at first sees it that way; but when the sides are reversed, the block seems to be tipped backward against the action of gravity, and an effort of the will is needed to make it assume that position, although the lines of perspective indicate both positions equally well. In order to prevent this confusion in drawings of crystals, etc., the back lines are usually drawn dotted or broken, to indicate their position.

When the eye is placed in an unusual position, it loses its power of judging of size or distances. A very pretty experiment to show this, is illustrated in Fig. 2, taken from *La Nature*. Take a board or the end of a box, and drive into it a nail or screw about three inches and a quarter in length. Attach to its end, by means of sealing-wax, a quarter of a dollar, the "head" side facing outwards. At

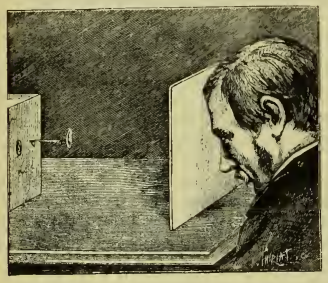

FIG. 2.

the side of it attach to the board a half-dollar with the same side in sight. Then, by looking at the two coins with one eye, through a small hole about one twenty-fifth of an inch in diameter in a sheet of cardboard, both coins will appear to be of the same size, and, by slowly moving the cardboard towards the coins, the quarter-dollar piece may even appear to be the largest. The distance between the coins and the eye varies with different persons, from six to ten inches; but the proper distance can easily be found by experiment.

A similar illusion occurs when one views the moon through a telescope. The magnified disk appears to be much smaller than when seen by the naked eye, though the reverse is really the case. In such cases seeing is *not* believing, and the proverb is only true when our eyes do their "seeing" under the familiar and accustomed conditions.

[Specially reported for the *Science News* from the Observatory of the College of New Jersey.]

ASTRONOMICAL PHENOMENA FOR JULY, 1887.

THE sun is in apogee — that is, it reaches its greatest distance from the earth — about 4 A.M. July 2. Mercury at the beginning of the month has just passed its greatest eastern elongation; but it is so far south of the sun, that it can be seen only under the most favorable conditions. It passes inferior conjunction with the sun on July 28. Venus will be very brilliant all through the month. It reaches its greatest eastern elongation, 45° 33′, on July 13, and the sun begins to overtake it after that date; but the relative motion of the two bodies is comparatively small. It sets about three hours after the sun. On any clear day during the month it may be seen in full sunlight by any one with reasonably good eyesight, if he only knows just where to look for it. It was first detected here by daylight on the afternoon of May 23, twelve weeks before the time of greatest brilliancy. It is generally not a very easy thing to find it by daylight; but, when once found, it seems so bright that one wonders he could not find it more readily. Perhaps the best way of finding it by daylight is the following: Fix the line of direction of the sun at noon by sighting along some terrestrial object, — the wall of a house or the top of an open window, for example. Then, about 3 P.M. (a few minutes earlier, toward the close of the month), Venus will be on the same north and south line, and below the position which the sun occupied, about 9° at the beginning of the month. This distance will increase to about 17° at the close of the month. Mars is a morning star, but still too near the sun and too far from the earth to be conspicuous. By the end of the month it rises a little more than two hours before the sun. Jupiter is still in good position for observation, passing the meridian a little before sunset. It is in quadrature with the sun on July 19. It is slowly moving eastward among the stars, and is a little north of east from the first-magnitude star Spica (*Alpha* Virginis), the distance increasing from about 5° at the beginning of the month to about 7° at the end. Saturn is too near the sun to be seen, except perhaps for a day or two at the beginning of the month. It passes conjunction with the sun, and becomes a morning star on July 18, but does not, by the end of the month, get far enough away from the sun to be seen. Uranus is moving slowly southward and eastward, and at the end of the month is about 2° south of the third-magnitude star *Gamma* Virginis. Neptune is a morning star, south and a little east of the Pleiades.

Another comet was discovered on May 12, in the constellation Lupus, by Mr. E. E. Barnard of Nashville, Tenn. At present it is moderately bright for a telescopic comet. Its orbit lies wholly outside of the earth's orbit.

M.

PRINCETON, *June* 1, 1887.

THE LIQUID ISLAND. — A half-pint flask should be half filled with a saturated solution of sulphate of zinc; about a drachm of bisulphide of carbon, tinted with a trace of iodine, should then be carefully poured on the surface of the zinc solution, and the flask filled up with water; the latter should be carefully poured in, down the side of the neck, so as to mix as little as possible with the zinc. The carbon bisulphide will assume the shape of a perfect amethyst-colored sphere, floating between the liquids, and, if undisturbed, will last for weeks. The zinc solution should be filtered before using, as otherwise it is likely to be turbid.

METEOROLOGY FOR MAY, 1887, WITH REVIEW OF THE PAST SPRING.

TEMPERATURE.

AVERAGE THERMOMETER.		LOWEST.	HIGHEST.	RANGE.
At 7 A.M.	55.52°	46°	68°	22°
At 2 P.M.	70.16°	48°	87°	39°
At 9 P.M.	56.29°	44°	71°	27°
Whole month	60.66°	44°	87°	43°
Second average	59.56°	44°	87°	43°
Last seventeen Mays	57.43°	51.34°, in 1882.	64.28°, in 1880.	12.94°
Second average	56.63°	50.67°	63.64°	12.97°
Spring of 1887	44.53°	9°	87°	78°
Last seventeen springs	44.92°	42.15°, in 1875.	49.09°, in 1878.	6.94°

The lowest point reached during the month (44°) was on the evening of the 13th, and the highest (87°) was at 2 P.M. on the 20th. The coldest day was the 28th, the mercury standing 48° at each observation, — a singularly uniform temperature, with gentle rain in the forenoon. The 20th was the warmest day, with an average of 73⅓°; the last four days averaged only 52⅝°; while one week (19th to 25th) averaged 67¼°. The entire month was 3.23° above the mean for the last seventeen Mays. The temperature of the spring has been only 0.39° below the average of the last seventeen springs.

SKY.

The face of the sky in 93 observations gave 53 fair, 15 cloudy, 22 overcast, and 3 rainy, — a percentage of 57 fair. This average for the last seventeen Mays has been 56.3, with extremes of 41.9 and 78.5. The present May has been more fair than any May for the last seven years. The month opened with several fine, warm days; had one quite warm week, but closed with cool, cloudy, and uncomfortable weather, there being only two fair observations during the last week. The average fair during the present spring was 51.8 per cent, that of the last seventeen springs being 52.4 per cent.

RAIN.

The amount of rainfall the past month was only .84 inch, with excessive easterly winds; the amount nearer the sea-coast has been much greater. The average amount during the last nineteen Mays in my locality has been 2.85 inches, with extremes of .55, in 1878, and 4.60, in 1882. The rainfall in May has generally been peculiarly uniform, about 3 inches, having fallen below 2 inches but three times, and having exceeded 4 inches but once, in nineteen years. Such uniformity in this respect is worthy of notice, being most favorable to vegetation when every thing in our climate is just starting into new life. We had scarcely one-tenth of an inch till the last week in the month, and the need of rain began to be severely felt. The amount since Jan. 1 is still, however, in excess of the average, being 25.57 inches, while that average has been only 21.58. The amount the present spring has been 11.33 inches, and the average for the last nineteen springs 11.98.

PRESSURE.

The average barometer the past month was 30.038 inches, with extremes of 29.60, on the 26th, and 30.30, on the 2d and 3d, — a range of .70 inch. The average pressure in May in fourteen years has been 29.941, with extremes of 29.868 and 30.038. This average in May has reached 30 inches but twice in fourteen years. The pressure was remarkably high and uniform during the first two-thirds of the month. The daily variations, as usual in May, were small, amounting to only 3.75 inches, giving an average daily movement of .121 inch; while this average for the last fourteen Mays has

been .126, with extremes of .073 and .170. The largest daily movements were only .46 and .30, while 14 observations were stationary. The average pressure during the present spring was 29.930, and for the last fourteen springs 29 900.

WINDS.

The direction of the wind in 93 observations gave 7 N., 7 S , 17 E., 9 W., 8 N.E , 13 N.W., 11 S.E., and 21 S.W., — an excess of 11 southerly and only 7 westerly over the northerly and easterly, and indicating the prevailing direction to have been W. 57° 32′ S. The westerly winds have uniformly prevailed over the easterly in May for eighteen years, with one exception (3 E. in 1881), by an average of 23.28 observations, and the northerly over the southerly, with six exceptions, by an average of 2.39; indicating the approximate average direction for May to be W. 5° 52′ N. The longitudinal extremes have been 3 E. and 64 W., a range of 67 observations; and the latitudinal 26 S. and 39 N., a range of 65. The relative progressive distance travelled the past month was 13.04 units, and during the last eighteen Mays 427 such units, — an average of 23.72; showing more opposite winds the past month than usual. The average direction of the wind the present spring has been W. 35° 40′ N., and for the last eighteen springs W. 28 7′ N.; showing unusual northerly winds this season.

D. W.

NATICK, *June* 4, 1887.

[Special correspondence of the *Popular Science News.*]

PARIS LETTER.

THE Paris Medical School has been sadly afflicted of late by the death of two of its eminent members. One was Professor Gosselin, a very distinguished surgeon, president of the Academy of Sciences, who died about a month ago ; the other was the world-known physiologist Vulpian, perpetual secretary to the Academy of Sciences, who was buried a week ago. Vulpian was one of the best original workers in the Medical School; and his books, unfortunately too scarce, are very much appreciated. His scientific career began in the Museum of Natural History when he was assistant professor during a short time, under Flourens. He then became a Fellow of the Medical School, was for some time professor of pathological anatomy, and ultimately of experimental pathology. He was also for some time dean of the Medical School, before Beclard, now also dead. He was recently appointed to the very elevated situation of perpetual secretary to the Academy of Sciences. His principal works are all on the physiology and pathology of the nervous system, on cerebral localization, on diseases of the spinal cord, on the vaso-motor nerves, on the physiological action of curare, strychnine, etc. He was much beloved of all the students, and his untimely death is a great loss to French science.

A SERIES of papers have been recently published by MM. Frédéricq, De Varigny, and Giard, concerning a curious fact recently observed in various animals, — that of spontaneous mutilation under various circumstances. The fact has been especially studied upon crustaceans by MM. Frédéricq and De Varigny. It consists in this: If the tip of the limb of a common crab be cut off with scissors, or crushed between two stones, or in some other manner (electrical or thermic stimulation) a violent pain be induced, the animal immediately lets go the affected limb. He breaks it, by means of voluntary exertion, in the middle of the first segment, by a process which has been well explained by M. Frédéricq. The animal raises the limb so as to rest it upon the protruding border of the shell overhead ; and then, by sharp contractions of the muscle which has already effected this movement, and of the counter-muscle, he breaks the limb, which falls immediately. In the like manner two limbs may be successively caused to fall off, provided the crab be a vigorous one, and the painful stimulations be strong enough, as M. de Varigny has shown. The reason of this act is sufficiently explained when one perceives that the limb, when cut by voluntary mutilation, does not bleed at all, the wound being stopped by muscles and a sort of membrane ; whilst, when cut (as it is by the experimenter) in any other spot, it bleeds exceedingly, and endangers the animal's life. This spontaneous mutilation is therefore of great use to the animal. It is a reflex act, and is under the dependency of the nervous centres : it always happens, provided the nerve connections are kept up, and the pain is sufficiently great. It must be noticed, however, that a wound of the extreme tip of the limbs does not cause any mutilation : the wound or pain must be inflicted in any of the parts except the distal one and the distal part of the one before it. It is not all crustaceans which are possessed with this curious power of spontaneous mutilation, as M. de Varigny has remarked. All crabs, or nearly all, provided they are strong enough, are possessed with it. Some *macroura* are in the same case (lobster, gray-fish, some *paguri*); but many are not, such as *palemon* and others. Spontaneous mutilation is observed in some insects, in some spiders, and also in some vertebrates (serpents and lizards) whose tails are well known to break easily when they are caught by that part. The *glass-serpent* of some parts of the States is also a good example of the spontaneous mutilation, if the notes published in the *Popular Science Monthly* of late are correct, although no scientist would indorse the statement that the ruptured parts come together again, after the danger is past. In lower animals, such as *Echinodermata* (comatula, asterida, etc.), cases of spontaneous mutilation are not rare. The fact is a curious one, and well deserves a notice. It would be interesting if some American students could take the subject up, and see to what extent the same fact is observable in American fauna. MM. Frédéricq, De Varigny, and Giard's papers will be found in the *Archives de Biologie* (1884) and the *Revue Scientifique* (1886-87).

RECENT experiments on the new French torpedo-gunboats have shown that the proposed system is yet a failure, as has been prognosticated from the beginning by many. Two facts are now quite clear : the one is, that the torpedo-boats cannot be of any use if the sea is not calm. They shake so very much that it is impossible to aim at any thing, and they have to keep the openings by which the torpedoes are expelled, shut. They can be of use, if the water is quiet, in the vicinity of *terra firma*, near harbors, coves, etc., but not in the open sea, even with a very moderate swell. The second point is, that the shaky motion, which is the consequence of the presence of a large engine in a small boat, affects the mechanism of the Whitehead torpedoes in a very potent manner, and renders them unfit for service. The worst of it is, that no exterior sign shows when nor how the torpedo is impaired ; and the consequence of the use of such torpedoes is, that the aim is quite erroneous, and that, although very well aimed, as it seems, the torpedo strays far away from the spot it is directed to. This inconvenience is a formidable one, and it is due to the bad influence exerted by the throbbing of the engine upon the very delicate adjustments of the regulatory mechanisms of the torpedoes.

IT is often repeated, that *nil sub sole novum*. A new demonstration — if one were needed — of the accuracy of this very old saying is furnished by the history of cremation. Many persons believe that the proposal of incinerating dead bodies, instead of allowing them to decay in the earth, was in modern times a recent one. A French writer has recently published a paper showing that such is not the case. Cremation was strongly advocated in the last century by a man named Beeker, a German physician. His idea was, to incinerate dead bodies, and then convert the cinders into glass which would have been moulded into all sorts of ornamental designs, — trinkets and such, — and given to the family of the deceased. This idea was followed by an architect, Guirand, under the French Revolution. He also proposed converting the cinders into glass ornaments; and as for the unclaimed bodies, he proposed using them, after conversion into glass, as materials for a sort of monument made up with pillars, urns, etc , which would have been erected in the middle of the funerary grounds. The plan met with general hilarity, and the idea of cremation was abandoned for some time. At present, as is well known, the idea is in good progress, and Paris will soon be endowed with a crematory.

H.

PARIS, *May* 27, 1887.

[Original in *Science News.*]

THE CIVET.

BY W. P. UNGERER.

THE personal appearance of the civet is certainly any thing but prepossessing; but, if his countenance is gloomy and malignant in captivity, the precious substance that he yields is, no less, one of the most peculiar and expensive perfumes in existence. There are two distinct varieties of the wonderful beast. The *Viverra civetta*, or true civet, is peculiar to Abyssinia and the southern division of Africa, where it is vulgarly known by the name of musk-cat. It may be distinguished by

its projecting teeth, small and piercing eyes, and short, rounded ears. The hair is long and thin, the color varying from a grayish black to light gray, darker on the back, where it forms an erectile mane. Its flattened sides are brinded with black, irregular stripes. It is a bloodthirsty animal, and is an object of fear and abhorrence in this region, although it rarely moves abroad during the day, but passes the hours of light and heat in slothful slumber, hidden from prying eyes. The *Viverra zibetha* of India and the Philippine Islands differs in no essential particular save its short and thick hair and a much longer neck; the description of one may serve for that, with this single variation. In many ways the civet resembles both the jungler and the cat, the latter especially in disposition and size.

Nature has furnished him with a powerful odoriferous fluid or matter, secreted in a cavity or pocket divided into two parts more or less profound, which open near the anus of the animal. This substance is known as civet, or *civette ;* it is extracted from him once a week, while he is firmly attached to his cage by means of strong chains and

ropes. A small spoon is introduced into the pocket while he is thus helpless and harmless, and the precious perfume is withdrawn with care; he is fed with raw meat, eggs, birds, and small animals.

As a perfume, civet is one of the greatest favorites of the Abyssinian and Oriental women; they apply it to their clothes and their hair. About seven hundred pounds of civet is used yearly in the United States in the manufacturing of perfumes, not for the sweetness of its odor as much as its peculiar and lasting properties; it possesses, like musk, the property, when added in a minute quantity, to augment the odor of other perfumes, without imparting that of its own, thus rendering it a most valuable ingredient in the art of perfumery. This substance must not be confounded with musk, which is altogether different, although it has some similarity with it, and both are often used by the perfumer together. Civet is a concrete mass, semi-fluid, with the consistency of thick honey, and has the peculiarity of keeping in any climate without hardening or putrefying. When taken from the animal it is of a yellow-brown color, but by exposure the surface turns to a dark brown. We usually receive it in this country in ox and goat horns. It is rarely pure, being adulterated by the natives either with honey or excrements of other animals.

The quantity and quality of civet obtained from this animal depend upon the nourishment upon which he is fed, and the way he is kept, the quantity doubling when he is well taken care of. Hundreds of these animals are kept in a state of captivity on the outskirts of Abyssinia, and supply the world with civet.

As the skunk ejects his offensive liquid when pursued by man or animal, so does the civet when he is excited in his cage by his keepers, who torment him; he then rubs the matter against the edges of his cage, intending, in his rage, to cover his assailant with it. In this state, it is believed to be the finest of civet. I owe to the courtesy of my friend Dr. Augustin Merle, in Abyssinia, a sample of civet produced in this manner. It was of a lighter color than the ordinary market civet, and proved to be far finer in quality than any I had ever seen.

Correspondence.

Brief communications upon subjects of scientific interest will be welcomed from any quarter. The editors do not necessarily indorse all views and statements presented by their correspondents.

TUNGSTEN STEEL.

EDITORS POPULAR SCIENCE NEWS:

YOU say of tungsten, in your May number, that its use in steel-making has not been commercially successful. It is well known that the "Mushet" steel, which does not require tempering, is made by an addition of tungsten. This steel retains its hardness at a temperature that would render common or carbon steel quite soft, and is indispensable where heavy cutting at high speed is required; the tungsten steel retains its hardness where the heat of friction would soften a tempered tool so as to be useless. This steel was brought out by the well-known metallurgist Mushet, the inventor of the re-carburizing process that made the Bessemer process practicable, and is made, with varying degrees of success, by almost every maker of tool-steel in America. Practical experience seems to be all that is necessary to its being made with as much certainty, as to quality, as common carbon steel.

Yours truly,

X.

QUESTIONS AND ANSWERS.

LETTERS of inquiry should enclose a two-cent stamp, as well as the name and address of the writer, which will not be published.

QUESTIONS regarding the treatment of diseases cannot be answered in this column.

C. E. B., *New York.* — What kind of potassium is it which burns on being wet?

Answer. — There is but one kind of potassium. It is a light metal, which floats on water, giving off hydrogen gas, which takes fire spontaneously. Care must be taken in using it, as the globule of metal usually explodes towards the end of the experiment.

F. S., *Milwaukee.* — Is an absolute vacuum a conductor, or non-conductor, of electricity?

Answer. — A vacuum as perfect as can be produced will not allow the passage of an electric spark, and may be considered as a non-conductor. Certain electrical movements, however, have lately been observed to take place in such a vacuum, which seem to show that the presence of matter may not be absolutely necessary for the transmission of electricity. See a note on this subject in the *Science News* for February, 1887, p. 20.

A. M. T., *New York.* — What is the formula for determining the volume of a gas under any given pressure?

Answer. — According to Boyle's law, $V' = \frac{VP}{P'}$, where V equals the known volume at a known pressure, P, and V' equals the volume at the required pressure, P'. Under ordinary conditions all gases are subject to a pressure of fifteen pounds to the inch, from the weight of the atmosphere; so that in some cases the formula must be modified to $V' = \frac{VP}{P' + 15}$.

C. N. M., *Tenn.* — Is it true, that, after the air has been expelled from water by boiling, it becomes explosive?

Answer. — Under favorable conditions water may be heated to a point above 212°, when any slight disturbance will cause it to flash into steam. This, however, can only be accomplished with the greatest care, and rarely or never occurs under ordinary conditions. It is a scientific experiment which you need have no fear will occur in your tea-kettle or hot-water boiler.

S. F., *Boston.* — The two wicks filled with water placed alongside of the oil-wick in a kerosene stove would not add to the heating-power of the flame, but would rather diminish it.

J. G. G. writes that certain English sparrows have been found to be covered with buffalo-bugs. We are afraid the story is too good to be true; but if these two pests will only learn to destroy each other, like the famous Kilkenny cats, a great domestic and agricultural problem will be easily solved.

SUBSCRIBER, *Chicago.* — Is it true that the human eye can be removed from its socket for surgical treatment, and replaced, without injuring the power of vision?

Answer. — This is a very common belief, but is utterly without foundation. The act of removal would sever the optic nerve, and it would be impossible for it to reunite.

N. T. S., *Buffalo.* — Ordinary washing-soda, or sodic carbonate (Na_2CO_3), is extensively used to clean waste water-pipes, but is much less effective than *caustic* soda, or potash (KOH). The latter can be obtained at any drug-store, and can be placed in the pipes to dissolve. It is a powerful caustic, and must be kept away from the flesh, clothing, or furniture.

E. S., *Ledyard.* — Can granulated sugar be adulterated with glucose?

Answer. — The powdered glucose can be mixed with granulated sugar, but the form of the sugar crystal is so distiuctive that the admixture could be easily detected with a magnifying glass.

LITERARY NOTES.

Dermatitis Venenata: An account of the action of external irritants upon the skin. By James C. White, M.D. Cupples & Hurd, publishers, Boston. Price $2.50.

The effect of the various irritants of vegetable, animal, or inorganic origin, is a subject of much importance to the practising physician, and Dr. White has covered the ground most thoroughly in this work. The symptoms of the various kinds of skin poisoning are given, with directions for treatment, and are followed by a list of the substances and animals to which irritating properties have been attributed, and their particular action upon the skin. The majority of our readers will probably be surprised to learn that there are over one hundred different plants capable of producing such effects.

The Cremation of the Dead. By Hugo Erichsen, M.D. Published by D. O. Haynes & Co., Detroit, Mich.

The interest in cremation is steadily increasing, and this scientific process of disposing of the dead is constantly coming more and more into favor. Dr. Erichsen gives a most interesting account of the various methods in use, from the funeral pile of the earliest savages, to the crematoriums established at Washington, Buffalo, and Lancaster within a few years. It is a powerful argument for cremation, and should be read by all those interested in the subject.

The Vest-Pocket Anatomist (founded upon Gray). By C. Henri Leonard, A.M., M.D. Detroit: The Illustrated Medical Journal Company, 1887. Cloth, 86 illustrations, 154 pages, post-paid, 75 cents.

This little volume in its former editions is so well known that it is only necessary to confine our notice to this, the *thirteenth* edition, which contains very clear and accurate topographical plates of the venous, arterial, and nervous systems, photo-engraved from the English cuts in *Gray's Anatomy*. This book, since it has the addition of these eighty-six engravings, is of a good deal of value to the country practitioner, who sometimes does not have the time to return to his office to consult his more pretentious volumes.

Public Health. The prize essays of the American Public Health Association. Published by the Republican Press Association, Concord, N.H. Price 65 cents, cloth; 30 cents, paper.

The four essays contained in this book are written by prominent physicians in a popular style, and are of the greatest value. They include the subjects of "Healthy Homes and Food," "Sanitation of Schoolhouses," "Precautions against Infectious Diseases," and "Avoidance of Accidents and Injuries in Workshops." The essays may be had singly for 10 cents.

Earth as a Topical Application in Surgery. By Addinell Hewson, M.D. The Medical Register Company, Philadelphia, publishers.

This book is devoted to the advantages of the use of earth as a surgical dressing for wounds, etc., with numerous reports of cases successfully treated. The more important ones are illustrated by photo-engravings taken directly from the patients.

Ligaments: their Nature and Morphology. By John Bland Sutton, F.R.C.S. P. Blakiston, Son, & Co., Philadelphia. Price $1.25.

This treatise gives a systematic account of the ligaments and fascia in general, with special attention to their morphology and ancestral history. It will be of interest both to the physician and the student of comparative anatomy.

Outlines for the Management of Diet. By Edward Tunis Bruen. J. B. Lippincott Company, Philadelphia. Price $1.00.

The substance of this little volume was delivered in the form of lectures to the nurses in the Philadelphia hospitals. It treats of the laws of digestion and nutrition, with special reference to the diet of the sick. Those having charge of invalids, either as physician or nurse, will find much valuable information in its pages.

Elements of Botany. By Edson S. Bastin, A.M. Illustrated with five hundred engravings. Chicago: G. P. Engelhard & Co. Price $2.50.

This elementary treatise is well adapted to the use of those commencing the study of botany, the facts and principles of the science being presented simply and clearly, with due regard to the growth of the mental faculties of the student.

Elementary Microscopical Technology. Part I. By Frank L. James, Ph.D. Published by the St. Louis Medical and Surgical Journal Company, St. Louis, Mo. Price, cloth, 75 cents; paper, 50 cents.

This first part of Dr. James's work is devoted to the history of a microscope slide, giving directions for the preservation and mounting of specimens. It is especially adapted to amateur microscopists, who will find its full and clear instruction a great help to them in the constantly occurring difficulties.

Pamphlets, etc., received: *Colonial Liquor Laws*, by G. Thomann; *Treatment of Lung Troubles by the Rectal Injection of Gases*, J. F. Queen & Co., Philadelphia (price 25 cents); *Sixty-third Annual Report of the Hartford (Conn.) Retreat for the Insane; Thirty-third Registration Report of Rhode Island*; and the *Reports of the Agricultural Experiment-Stations of Connecticut, Iowa*, and *Georgia*.

Medicine and Pharmacy.

PHYSICAL AND MENTAL DEVELOPMENT IN THE AVERAGE BOY.

Having in previous papers spoken of the management of *precocious children* and of *dull boys*, we have been urged to say something about the *average* boy in his relations to physical and mental development, and domestic ethics. By the average boy is not meant the prodigy who can talk at six months, walk at ten months, repeat the "Busy Bee" at two years, and recite the multiplication-table at four years of age. Neither is our hero the proper, goodish boy, who never soils his pinafores, or frock, or trousers; who prefers to stay in the house, and sew patchwork, and crochet, rather than to tumble on the green or toss a ball; who never laughs or makes a noise on Sunday, but "sits still" in his little chair, and looks at his colored pictures of the infant Samuel, or Daniel in the lions' den, as any young saint should. We leave these anomalies to the writers of pseudo-religious story-books to work up into heroes, while we attempt to speak a word in behalf of the representative boy as you find him in the house, in the street, and in the field.

Every boy born into the world has certain inherent rights, which are as truly his as are any of the prerogatives of the father. He has a right to live, and move, and have a being. He has a right to his share in the comforts of home, in the products of his father's wealth and industry or prestige of inheritance. He has rights belonging to a thinking soul, with aspirations and longings that reach far into the future. And yet, how many treat boys as though they were merely dependencies, suffered to come to the table, and share in the comforts of home, but made to feel as if this were only granted by special favor, for which they should be constantly thankful!

How often are men so completely immersed in business that they know but little about their families! They keep them out in a country residence, which they visit at night, just giving themselves time to scold at the boys and find fault with the servants, and then off again in the morning, leaving all the care and responsibility to the poor mother, who is early broken down by discharging duties which should be shared by the husband; and the unreasonable man wonders why his boys do not take more interest in his business matters, and why they are so shy and distrustful of him.

What did he ever do to interest them? Does he ever confide in them? Does he ever talk to them about his business, — explain some of its peculiar elements, and show how certain things are accomplished? Do these boys know how their fathers make their money? or have they ever been instructed as to what they should do if the father should be suddenly stricken with apoplexy or death? If they are kept in ignorance of all this, they should not be blamed for their weakness and inefficiency. The father must take his boys early into his confidence if he would have them feel an interest in the things which rightfully belong to them. Let them know and feel that they are interested in the father's prosperity, and sharers in his successes. Let them feel the honest pride that comes from conscious ability and self-reliance. How often are boys, by mistaken and ruinous kindness, treated like helpless babies! They are not allowed to go out of the range of the paternal eye; and they grow up to manhood unused to the world, and timid and tame, because over-anxious parents were fearful that some accident might befall them.

As a means to healthful mental and physical development, encourage boys to indulge in vigorous, dexterous sports and pastimes. Let them row and swim and ride horseback with ease and freedom, and do not oblige them to steal the opportunity to practise these recreations, and carry on a deception because of unreasonable parental timidity. Boys cannot be too early taught the lesson of self-reliance and self-protection. The dexterity shown in the sports of youth manifests itself in various ways in after-life. Who are the cunning artificers, the nice mechanics, the bold inventors, the skilled artisans, but the dexterous, bold, and ingenious boys whose parents indulged them in the reasonable use of all the appliances of youthful pastimes?

But still another element should enter into this process of development in the average boy. He should have something to do in the way of *labor*, no matter how wealthy his parents may be. He should be made to feel that life has stern duties, and that he must be a sharer in them. Therefore let every boy have some specified work to do, aside from his regular studies; and hold him accountable for it, be it ever so simple. How many boys become indifferent men because they were never taught the importance of having a *purpose* in all they attempt. Physical and mental activities are analogous in depending upon a *system* of growth in their healthy development.

That mind soon becomes sluggish that is not thrown upon its own resources, and compelled to do something in the line of investigation. To have every thing ready made, and obtained without the cost of research, is surely a weakening process, and no greater harm could be done to an inquiring mind than to answer all its questionings, unravel all its doubts, and attempt to explain all its mysterious yearnings for something larger and better. These discoveries come through the processes of healthy mental development. The mind needs the hints and the impetus that come from wise and judicious oversight. But the training must come from within. It must be the result of that introspection that unfolds the capabilities of the mental forces. In attempting to *mould* the character of another, we should have a care not to destroy its identity by shaping it after the fashion of our own ideal, and making it suit our own fancy or caprice, rather than to unfold the hidden springs of its own individuality, and make it noble by self-knowledge and self-reliance. There are too many tame characters all around us, the results of that false system of education that assumes that all minds need the same processes of mental training, without the study of individual powers, proclivities, and possibilities. Make the most of the average boy, by unfolding to him those hidden sources of power which become mighty by a wise and persistent development and conversation.

[Original in *Science News.*]

HOUSE-DRAINAGE.

BY MAURICE D. CLARKE, M.D.

II.

There is one point concerning traps about which there will be little dispute, and that is, that, other things being equal, the simplest trap is likely to be the best. In fact, this is true of all plumbing appliances. Every complicated device must prove itself of additional value to pay for the annoyance and danger of its additional mechanism; and this, it goes without saying, most of them fail to do. Almost the simplest trap known is an ordinary pipe bent in the form of the letter S (Fig. 1.), the bend being intended to retain a certain amount of the water that passes through the pipe. Now, if the intention was always carried out, if we were sure of always having water in the bend, nothing more than this need be asked for, simple as it is. The latest experiments seem to settle it, that sound water-seals in a ventilated system of pipes afford complete protection. "They exclude," says Dr. Carmichael, who contributed a series of careful articles to the *Sanitary Journal* of Glasgow, "the soil-pipe atmosphere to such an extent, that what escapes through the water is so little in amount, and so purified by infiltration, as to be perfectly harmless; and they exclude entirely all germs and particles, including, without doubt, the specific germs or contagia of disease, which we have already seen are, so far as known, distinctly particulate."

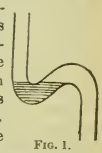

Fig. 1.

Unfortunately, however, this means of protection does not always protect, simply because the water, which is the protecting agency, cannot always be depended on to stay in the pipe. There are conditions always operative in a system of house-drainage that tend to destroy the water-seals, and among the most important of these is siphonage. Let us suppose that the waste-pipe of a wash-bowl trapped with an S trap is carried into the main pipe below the outlet of a water-closet. When the closet is emptied, a large amount of water, which completely fills the main pipe, falls suddenly through the latter, and the air behind the falling water is rarefied. Just after it has passed the opening of the waste-pipe of the wash-bowl, the pressure of the atmosphere above the water in the wash-bowl trap is greater than that below it; and therefore the water, more or less of it, is driven out: nor does it take many repetitions, if any, to drive out enough to make the trap temporarily useless. The discharge from any fixture in the house, provided it has volume and speed enough, can unseal the trap of any other fixture. The same result may be occasioned by a process completely the reverse, known technically as "back-pressure." The air in front of the falling water is condensed, and the pressure in connecting-pipes is therefore, until the water has passed by their outlets, greater, and may be enough to drive the water of their traps backward into the fixtures, and sewer-gas with it.

To overcome this very serious defect of siphonage, many devices have been proposed, among

which is the plausible one of ventilating each pipe just beyond the trap, by a special pipe; and thus, by equalizing the pressure, making siphonage impossible. Without referring to other objections, it is enough to say that this plan has the serious fault of destroying rapidly, by evaporation, the very seal it is endeavoring to protect from siphonage, and also of itself soon becoming clogged and useless. Another device, and a very common one, probably often recommended by the best class of plumbers, is a trap larger than the S trap, and of a different shape, called the pot-trap (Fig. 2). If this is big enough, it will resist siphonage; but its very size compels it to retain more dirt and waste than the ordinary trap, and it demands, therefore, constant watchfulness and frequent cleansing. Under the kitchen sink, for example, it is likely to be nearly filled with grease, when it becomes practically a very dirty S trap (Fig. 3). Traps of all sorts and shapes, with all manner of devices, have been employed to obviate siphonage. Many of them succeed in this regard, but at the expense of failure in other particulars. All the mechanical traps (made with balls, valves, etc.) are believed to be objectionable, although they have good indorsers, because they retain filth; and, when clogged by filth, their mechanism loses its value. And, moreover, the argument advanced by the opponents of these devices seems to hold. In water-closet traps we are forced, say they, from the nature of the case, to have only water-seals, without mechanical obstruction; and, if we have only water-seals in the large traps, what is the use of any thing else in the small ones?

FIG. 2.

FIG. 3.

And this suggests, by a natural transition, the consideration of water-closets. These, it has been agreed to divide into two general classes, — those with movable machinery and those without. Of the former, the pan-closet is a type; and the pan-closet is at once the cheapest, the most popular (because the cheapest), and the filthiest of all plumbing appliances of the sort. Below the pan is a receiver that collects and retains filth, and which is directly connected with the room. No one who has seen a pan-closet taken apart after use, needs any further information about it, or wonders at the unanimity with which it is condemned by sanitarians. The others of the same class are objectionable, if in a less degree. All sanitarians are agreed in the opinion that closets of the second class are alone fit to use. These have a clear water-way from the seat to the soil-pipe, only a simple trap intervening; are made usually of one piece, or nearly so; and are flushed from above. The different makes vary, but this is the essential plan of all; and on the general type sanitarians are agreed, though individuals may prefer this form or that, for various reasons.

The man who has in his house these three things — a ventilated soil-pipe, trapped fixtures, and a suitable water-closet — has gone a long way on the road to safety, though it must be confessed that he may have to take his traps on faith. And these three things seem absolutely essential. It is difficult to see how a house can be free from the gas of organic decomposition unless the unprotected waste-way is reduced to a minimum, unless there is a free circulation of air in the pipes, unless the chief receiver of filth is made as simple and efficient as possible.

There are, however, other matters that deserve attention, and, among them, that most convenient institution, the set-bowl. As commonly made, it has a waste-way at the bottom, with a strainer which blocks up the outflow by about one-half or two-thirds, both usually filthy, stopped by a plug with a chain, both (from the nature of things) still more filthy. On the back side is an overflow waste, whose inside is coated with slime; rarely, if ever, flushed. Of course, the strainer and the upper part of the waste-pipe can be cleaned more or less, and should be, and perhaps the plug; but who would clean the chain? Not one servant in a thousand. Nor would it be easy for any one to clean the overflow waste, however ingenious, industrious, and zealous he might be. To correct these obvious errors, many bowls have been made, and many are making.

Then, the waste-pipes are often too large. They need to be of just that size that will allow of their being cleansed by the stream that is to pass through them. The entrances to waste-pipes from bowls, etc., should be of the same size as the pipes themselves, to insure a thorough flushing. The latter is accomplished by a good flow of water filling the bore; and this is hindered by narrow entrance-wastes, by over-big pipes, and by large traps. This is one trouble with the pot-traps. Their aim is to prevent loss of the water-seal by siphonage. The more effective in this direction, the larger they must be; the larger they are, the more the flow is checked; the more the flow is checked, the poorer the flush; the poorer the flush, the greater the accumulation of filth in the trap, and therefore, also, the less its protection against siphonage.

It is often asked whether the main drain should be trapped or not as it leaves the house, and upon this matter opinions are divided. Those who favor a trap, base its need upon the danger of allowing the whole system of sewers to ventilate through the house-pipes; while those who object to it claim that the trap itself, as a necessary retainer of more or less filth, and perhaps the cause of a setting back of filth into the main drain, is really more dangerous than the sewers. It is not apparent, on the face of it, why, with a clear ventilation through the soil-pipe above the roof, the danger from each is not reduced to a minimum; so that the whole matter would resolve itself into the question of which is the fouler, the main sewers or the trap. And the chances are, that a good sewer would be the cleaner of the two.

With kitchen and pantry sinks, an especial trouble arises from the accumulation of grease in the traps and along the course of the pipes, which detains with it a variety of particles of decaying organic matter. To prevent this, many arrangements have been devised, more or less effective. Probably one of the least effective is the pot-trap; and one of the best appears to be a large flush-pot, so-called, which is intended to retain the accumulated filth, and then carry it off in a mass at once. It is reasonable to suppose that the frequent use of a strong solution of an alkali — ammonia, e.g. — will dissolve from the pipes the accumulations of grease in an ordinary family.

Not the least in importance is a matter that the later sanitary writers emphasize, and that is, that the whole of the plumbing should be either in plain sight, or easily accessible. Of the two, the former is slightly preferable, because what is said to be easily accessible may not be. The old plan used to be a complete concealment. One did not know where the pipes ran; or, if he did, he couldn't get at them without a carpenter. The main drain was hidden in the cellar bottom; and, to look under the water-closet, one had to have it taken to pieces. In short, whether the work was meant to be done well or ill, whether as the builder wished or as the plumber chose, there was every temptation to makeshifts and dishonesty. Though this is not the main thing, the fashion needs to be changed, not so much for the discomfiture of the careless or cheating plumber, as to enable one to see for himself at all times if any thing is wrong with the plumbing, just as he now sees as to the rest of the domestic conveniences. And therefore, from water-closets, bowls, and sinks, the casings ought to be removed completely, or put on as if they were meant to be opened. Far better to have things open to view, and pipes, whether whole or defective, visible, than to have the plumber and the carpenter pull the house to pieces in a blind search.

This article is not a treatise on architecture, be it remembered. It leaves unsaid many things kindred to its subject. It is not meant to be dogmatic, but suggestive. It states some of the more prominent principles of house-drainage, which are indorsed both by authorities in sanitation and by the recommendations of common sense. But it is to be borne in mind that eternal vigilance is the price of safety in this matter. None of our labor-saving appliances but need tending. The employed, whether animate or inanimate, will always bear watching by the employer. So plumbing demands constant supervision and care; the best there is, cannot be safely left to itself. Wash-bowls, bath-tubs, water-closets, must be washed and scrubbed, like other utensils; soil-pipes watched for leaks; traps periodically examined and cleaned; and the lesson constantly insisted on, to mistress and maid, that health demands the cleanliness which is next to godliness, and which is entirely independent of traps and plumbers.

HAVERHILL, MASS., *April* 1.

MONTHLY SUMMARY OF MEDICAL PROGRESS.

COMPILED EXPRESSLY FOR THE SCIENCE NEWS BY W. S. WELLS, M.D.

ANOTHER case of transplantation of bone for the cure of ununited fracture is reported from Lyons, France. Professor Poncet had under his care a man who had sustained fracture of the tibia, the ends of the bones having become atrophied, and thirty-five to forty millimeters (an inch and a half) apart. He removed the first phalanx of the great toe of a leg recently amputated, sawed off the articular ends, and split the bone in two. One of these halves was fastened between the freshened ends of the broken tibia, with due antiseptic precautions. Fibrous union took place at one end, and bony union at the other.

A BERLIN journal some time ago gave an account of a singular feat of surgery performed by Professor Bergmann. Two cases presented themselves simultaneously at the clinic, — one of necrosis of the humerus, and the other for amputation of the femur. The operation for necrosis required an extensive removal of dead bone-tissue; and as soon as the amputation of the femoral bone was effected, Professor Bergmann used a large piece of the thigh-bone of the one to fill in the space made vacant in the arm of the other, and perfect union took place. If the man who owned the amputated leg was not consulted about the disposal of his lost limb, it will be as well for the other man to keep quiet regarding his title to his arm; for if the one-legged man should lose an arm, he might make an awkward demand for restitution.

CATHETERIZATION of the trachea and bronchus may now be easily accomplished by first anæsthetizing the parts by topical applications of cocaine. In a recent number of the *Berliner Klinische Woch.*,

Dr. Landgraf describes the case of a man who applied at Professor Gerhardt's clinic, suffering from symptoms of left-sided bronchial stenosis. He had attacks of coughing followed by dyspnœa of a severe character, and physical indications of interruption to the passage of air into the left lung. It was decided to catheterize the trachea, and, if possible, the bronchus. The larynx was anæsthetized by pencilling it with a twenty per cent solution of cocaine, and a ten per cent solution of the same drug was sprayed into the trachea. A catheter was then passed into the windpipe with the greatest ease, for a distance of about twelve inches, where it met with resistance. At a subsequent trial it passed the obstruction, and was introduced a considerable distance farther than at first, affording immense relief. This procedure was repeated several times weekly, and suggests the wider extension of the practice of direct medication of the sub-laryngeal air-passages, preceded by local anæsthesia.

A CASE is reported, in the *Sei-i-kwai*, a medical journal of Japan, of the resuscitation of a woman apparently dead, by the hypodermic injection of nitro-glycerine. The *Medical Press* also gives a case of collapse a few days after childbirth, the woman being at the point of death. Dr. Sackersteen, after exhausting other means, was about to abandon the case as hopeless, when it occurred to him to try nitro-glycerine. He injected ten drops of a solution of the substance into a vein. A minute elapsed before his patient gave a slight gasp; in another minute this was followed by three or four gasps; and after the third and fourth minutes the pulse was felt, and the heart was distinctly heard. A flush came over the face of the patient, the eyes opened, the muscles, which had assumed the rigidity of death, gradually relaxed, and she became conscious. In a few days the woman made a good recovery. It is suggested that the hypodermic injection of nitro-glycerine should be tried in other cases of collapse, as from overdoses of chloroform, or shock from surgical operation.

REPORTS are current of the discovery of a peculiar property in a plant, known in India as the *gymnema Sylvestre*, and which, two or three of its leaves being chewed, absolutely abolishes the tongue's power to taste sweetness. Its power to destroy the taste of any thing sweet suggests its use to correct morbid craving for sweetmeats, — a source of disorders of digestion. It is also reported to have been found that gymnema "abolishes the power of enjoying a cigar." Great expectations exist as to this accession to modern materia medica; but what this country is particularly in need of in this line of plants, is one which will take away, and keep away, the taste for whiskey.

Now that warm weather prevails, it should be remembered that infants require water to drink as well as milk. It does not follow, that because milk is a liquid, it is capable of satisfying thirst. On the contrary, being warm as it is drawn from the breast, it causes thirst after it has remained in the stomach for some time, the same as other food. It is this sense of thirst which causes healthy, breast-nourished infants to often cry for long periods of time after freely nursing. It is claimed that there are many cases of indigestion due to insufficiency of the child's gastric juice which would be greatly benefited, or even cured, by allowing the child, occasionally, a drink of decidedly cool water.

IT is stated by a Philadelphia editor that the treatment ordinarily employed in some of our hospitals for the comparatively trivial affection known as housemaid's knee, is unnecessarily severe. The contents of the sac can be evacuated without making an incision of two or three inches in length, and the injection of an irritating fluid is not often necessary or advisable. In the condition named, the normal cavity of the patellar bursa is distended by an excess of fluid; and all that is requisite, in nine cases out of ten, is to withdraw the contents, and rest the parts. This can be easily done, and effectually, by aspirating the sac, placing the patient in bed, applying a plaster bandage over the knee, and administering a brisk purgative. The chances under this simple treatment are, that no further excess of fluid will accumulate in the joint.

PROFESSOR SEMMOLA publishes, in *La Med. Contemp.*, a case of neuritis and myositis rheumatica, cured by pilocarpine. A lady about forty, in good health, after standing in a draught, was seized with great pain in the right shoulder and arm, which increased until all movement of the arm became impossible. Massage, liniments, galvanism, with salicylates and quinine internally, were prescribed. Months passed, but the conditions remained the same. Semmola, being called in consultation, suggested the injection, hypodermically, every twelve hours, of one-fourth graiu of hydrochlorate of pilocarpine. There was considerable improvement after the second injection, and in four days the patient was practically well.

PROFESSOR LISTER'S latest antiseptic dressing is known as sal-alembroth. It is stated to be a double mercurial salt made by the sublimation of a mixture of perchloride of mercury and chloride of ammonium. It is very soluble, and has not been used in mediciue since the time of the alchemists. All dressings — gauze, cotton, wool, bandages, lint, bedding, patients' underclothing, etc.— are soaked in a one to a hundred solution, and dried. He colors the dressings with aniline blue, one to ten thousand, so that, when an alkaline discharge comes in contact with the dressing, the blue color turns reddish, enabling one to see where the discharge is, and to judge as to its quantity, whether moist or dried. The professor uses it exclusively in his wards, and with good results.

THE *Paris Médicale* publishes notes of cases of malignant pustule, described by Dr. D. Frederico Rivas, which were cured with a paste composed of quinine-powder and essential oil of turpentine. The first case was that of a woman sufferiug from a pustule on the articulation of the metatarsal phalanx. Different treatments were tried without success. The paste above mentioned was then employed. The pain immediately ceased; œdema disappeared. A scab alone remained, which came away on the fourth day. Other cases were equally successful, especially one resulting from the sting of a fly on the face, producing intense œdema. The powder and essence should be mixed in quantities to form a soft paste, which should be often renewed, as it dries quickly.

CONTROLLING PATIENTS UNDER THE INFLUENCE OF NITROUS OXIDE.

DR. W. R. HOLMES, in the *Dental Luminary*, says: —

"I have been using nitrous-oxide gas in my practice for a number of years. It has been a habit with me to test the condition of my patients during the inhalation of the gas, by requesting them to raise the left arm. They usually responded, some continuing to raise and lower the arm until the effect of the gas passed off, seeming to be impressed with the idea that they must do so. The next occasion I had to administer gas, I made the usual examination of the mouth, and, after learning which teeth I was required to remove, I turned abruptly to the patient, and said, 'If, while you are under the influence of the gas, you hear me request you to open your mouth, do so; you can if you understand now that it is necessary.' I said nothing about raising his arm; but just as I thought he had inhaled enough gas, I said, 'Raise your left arm,' and was surprised to see, that, instead of doing so, he promptly opened his mouth wide. As his breathing indicated that he had enough gas, I dropped the inhaler, and extracted the teeth. After he regained consciousness, I said, 'Did you hear me ask you to raise your arm?' He said, 'I heard you tell me something; and, as you had charged me to open my mouth if asked to do so, I thought that was what you wanted.' I have taken advantage of this experience ever since, — some three years, — and have yet to meet the first failure. After charging the patient to respond by opening the mouth when told to, I proceed to administer the gas; and just before he passes under its influence, I say, 'Remember and open your mouth when I tell you to.' Thus the last thing the patient thinks of is opening his mouth, and almost invariably it is the first thing he does. I have tried the command without previous instruction, and failed to obtain a response I think this suggestion a valuable one, and will result in great benefit if properly attended to."

OLFACTORY ACUTENESS.

AN interesting contribution was recently made by Messrs. Nicholls and Bailey to *Nature*, giving the results of experiments upon the relative acuteness of the sense of smell in individuals. A series of solutions of oil of cloves, nitrite of amyl, extract of garlic, bromine, and prussic acid were prepared by successive dilutions with water, until the limit of perception was reached, and then the solutions were placed indiscriminately, and submitted to a number of persons of both sexes to classify them properly by the sense of smell. The results showed, that, on an average, the sense of smell was much more delicate in the males tested than in the females; but the degrees of keenness ranged widely as between individuals. Thus, three male observers were able to detect one part of prussic acid in two million parts of water, though its presence was not revealed by a chemical test; but others, of both sexes, could not detect prussic acid in solutions of almost overpowering strength. The following figures give the average limit of delicacy of perception: —

Cloves. — Males, 1 in 88,128; females, 1 in 50,667.

Nitrite of Amyl. — Males, 1 in 783,870; females, 1 in 311,330.

Extract of Garlic. — Males, 1 in 57,927; females, 1 in 43,900.

Bromine. — Males, 1 in 49,254; females, 1 in 16,244.

Prussic Acid. — Males, 1 in 112,000; females, 1 in 18,000. — *Phila. Med. and Surg. Reporter.*

THE "REVOLVER CURE."

THE *Baltimore American* publishes the following story, which, even if hard to believe, indicates the remarkable activity of the imagination of some one connected with its repertorial staff: —

"Ten years ago Mrs. Ada Martin, living in a small town in Ritchie County, punctured one of her limbs so severely as to cause permanent paralysis of it, and deprive her of her power of speech. During the period of her afflictiou she has been making crazy-quilts, and endeavoring to obtain patches from prominent men. Presidents Hayes,

Garfield, and Arthur sent her patches; and a day or two ago she received a patch from President Cleveland, with his compliments autographically expressed. Her pleasure at the event was so great, that she jumped up suddenly, and, in doing so, knocked a revolver to the floor, causing it to be discharged. The ball entered her paralyzed limb, and the shock removed the paralytic effects, and restored her speech. Ever since the occurrence she has had the use of her tongue, which for ten years has been silenced. The physicians say she will have the use of her limb as soon as the bullet-wound is healed."

A DOCTOR WHO COULD SHOOT.

THE *Indiana Medical Journal* is responsible for the following: During the twenty years which Dr. Ackley practised in Northern Ohio, his reputation became very great. He was a man who was impulsive in his actions, as is shown by the following incident: One day, while out duck-shooting, he was accompanied by his favorite dog. Another hunter was on the opposite side of the stream; and, as the ducks which he shot fell into the water, Dr. Ackley's dog would swim in and get them. The man objected to this, but Ackley told the man he should have all the ducks retrieved by the dog. The man answered, that, should the dog retrieve another duck, he would shoot him. Ackley replied, if the man shot the dog, he would shoot the man. Another duck was shot, and in sprang the dog, and was as promptly shot. Ackley reciprocated by filling the man full of shot from his fowling-piece, after which he immediately left the scene, and returned rapidly to the city. Some time later a man came into his office, complaining that some one had filled him full of bird-shot. Ackley proceeded to pick them out, one by one, at the same time condoling with the man; and, at the close of the process, charged him a good bill.

HUMORS.

DR. HOLMES has said: The patient may almost always be saved if the doctor is called in time; but he should be called two or three hundred years before the patient is born.

AN UNSUCCESSFUL OPERATION. — A young physician, just commencing practice in an adjoining city, was called to attend a child who had forced a bean into its ear. Acting upon a brilliant inspiration, he attempted to remove the foreign body by syringing the ear with water. The bean, absorbing the water, swelled to double its natural size, and the effect upon the child may be better imagined than described. An older physican, called in "consultation," removed the offending vegetable, with the aid of a hair-pin, in a fraction of a minute. The moral to this anecdote may be, that old methods are sometimes the best.

CUS AMERICANA. — One of our worthy contemporaries devotes an article to the therapeutic uses of *Cus Americana*, commending it as a reliable tæniacide. In America this plant is not only used in helminthiasis, but for many other purposes. The native product, however, known under the name of *C. Americana*, is said to embrace several varieties. In the mining regions of the Rocky Mountains and the Pacific coast, a variegated and profusely flowering plant, *C. occidentalis*, is found. This is largely used, and seems to be applicable to all sorts and conditions of men, much like quinine in the South, and whiskey in New York. It is said not to be incompatible with the latter used as a drug. The dose varies greatly, and is usually repeated. The *Boston Medical Journal* believes that "the effects of *Cus* is entirely incommensurate with the popularity of the agent."

The Popular Science News.

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SETH C. BASSETT,
MANAGER.

Publishers' Column.

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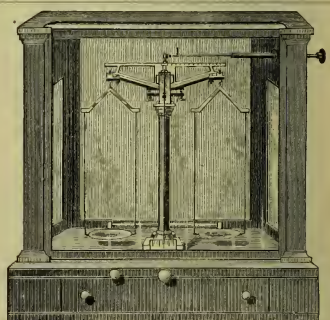

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The Popular Science News

AND

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CONTENTS.

FAMILIAR SCIENCE. — J. B. Boussingault 109
Field Geology 109
Weather Lunacies 111
Stray Lunagraphs 111
Atoms 112
PRACTICAL CHEMISTRY AND THE ARTS. — Novel Process of Iron Casting 112
Carbonic Dioxide in the Arts 112
Peroxide of Hydrogen as a Bleaching Agent 113
Hand-Grenades 113
Colored Glass 113
Building in Tunis 113
Railroad Notes 113
Easy Chemical Experiments 114
Practical Recipes 114
HOME, FARM, AND GARDEN. — The Science of the Tea-Kettle 114
Spontaneous Combustion 115
The Mysteries of Plant-Growth 115
A Vineyard for Sale 116
The Farmhouse Cellar as a Breeder of Diseases 116
Selected Recipes 116
Household Hints 116
EDITORIAL. — Shakespeare's Astronomy 117
Celestial Photography 118
A Miniature Balloon 118
Prehistoric Art 119
Astronomical Phenomena for August, 1887 119
Meteorology for June, 1887 120
Natural History Notes 120
The Barometer and the Winds 120
Questions and Answers 121
Literary Notes 121
MEDICINE AND PHARMACY. — Corpulence 121
Necessity of Exercise for School-Children 123
Etruscan Dentistry 123
Monthly Summary of Medical Progress 123
Medical Memoranda 124
PUBLISHERS' COLUMN 124

Familiar Science.

J. B. BOUSSINGAULT.

JEAN BAPTISTE BOUSSINGAULT, one of the most eminent of modern French chemists, died at Paris on the 11th of May, at the age of eighty-five years. His early scientific education was received from the St. Etienne School of Mines, where he obtained the degree of *ingenieur*. Soon after graduation he went to South America on a mining expedition. There he remained for ten years, exploring the country, and making many valuable discoveries of plants, animals, and minerals. His ingenuity in devising impromptu methods of analysis was very great. A small portable assay balance served to make in the field an approximate analysis of new minerals; and on one occasion, while visiting the volcano of Pasto, and wishing to determine the temperature of certain cavities in the crater, in the absence of any instrument he lowered down pieces of tin-foil, which were immediately melted, and a pistol bullet, which remained solid, thus proving the temperature to be between 235° and 332° C., the melting-points of tin and lead respectively. He described and investigated many South-American plants, including the now famous coca.

In 1833 he returned to France, and was appointed professor of chemistry at Lyons. In 1839 he became professor at the Conservatory of Arts and Trades at Paris, where he remained until his retirement, in 1873.

The researches of Boussingault were of the utmost importance. In connection with Dumas, he carried on a series of experiments upon the composition of atmospheric air, which have become classical; but it was in the field of agricultural chemistry that his most brilliant work was performed. In 1838 he published a work upon this subject, in which he showed that plants decompose the carbonic acid of the air, and appropriate the hydrogen of water, and also that the nitrogen of the soil is an important constituent of the cereal grains. His

farm of Bechelbronn, in Alsace, was the first of the numerous experimental farms now so common both in Europe and this country; and the experiments and analyses carried on there led to most valuable results.

He also gave considerable attention to physiological chemistry, as far as it pertained to the rearing and fattening of cattle; and during the latter part of his life, metallurgy, and the analysis of iron and steel became a favorite study. In fact, he was eminent in all the different branches of chemistry; and the whole world can sympathize with France for the loss occasioned by his death.

[Original in *Popular Science News.*]

FIELD GEOLOGY.

BY PROFESSOR N. S. SHALER.

IV.

Organic History of the Rocks; the Study of Fossils.

IN the three previous papers of this series the student's attention has been directed to the action upon the earth's surface of energy proceeding from the sun or from the interior of the globe. We have seen how these forces operate to build, to destroy, and to change the character of rocks; we must now turn our attention to another mode in which these forces operate upon the surface of this sphere. A portion of the energy which comes to the earth in a continued stream from the celestial spaces is embodied in organic life, exists for a while in the quickened state of animals and plants, and is perhaps manifested for geologic ages in the fossils which rocks contain. Each animal and plant exists in the living condition for but an inconceivably small period of time. At death the energy goes away from the body, and the body itself, in most cases, is resolved into its elements. Now and then, however, the remains of these living beings are entombed in strata, and become what we term fossils, — precious monuments, from which we may construct a history of life during the earlier stages of our planet. Although perhaps not one in a million of the creatures which have lived ever enter into the rocks in the form of recognizable fossils, yet so vast has been the total number of living things on the earth's surface, that the greater part of our stratified rocks are crowded with their remains.

The crystalline rocks, those which have been in the state of lavas, or which by metamorphism have been brought into the crystalline form, generally exhibit no trace of organic remains, even though they may preserve some signs of the bedding which originally characterized them. The stratified rocks formed during glacial periods, where they were laid down in waters lying close to the ice-sheet, are also generally without any trace of fossils. All the other rocks which have been formed on the floors of the sea or of lakes usually exhibit abundant organic remains. Almost every student of geology may find, in the district which is convenient to his residence, deposits of this nature, which afford a field of most interesting inquiry. There is hardly a place in the United States where fossils may not be found within a distance of fifty miles, and in most cases the rocks contain a great variety of organic remains.

In beginning a study of fossils, the student should make himself familiar with the rock outcrops of the district he has under observation; therefore this division of his inquiry can advantageously come after the studies which we have already prescribed for him. At first sight, fossils are apt to be overlooked by those who are not accustomed to search for them. The student must not expect to find these remains exhibited as clearly as are the bodies of living creatures. If he would obtain a proper knowledge of those which occur in his field, he must leave no exposure of stratified rock without a very close inspection. Where the deposits are very coarse sandstones or conglomerates, particularly in the latter case, it is not likely that they will yield fossils even to the most careful inspection, for deposits of this nature are generally formed under such conditions as make the preservation of organic remains extremely improbable. Where the beds are of a slaty or a shaly nature, the probability of finding fossils is much greater. Indeed, it is rarely the case that shales are entirely without organic remains. Where the beds are composed of limestone, we may be sure that they have once contained a great abundance of fossils, for the lime has been de-

posited by the action of organic forms, though in certain rare cases, the rock having become crystalline, the remains have been taken to pieces in the process, and thus entirely obliterated. Still, even where the limestones are somewhat crystalline, we may often find layers which have escaped that process, and in these portions of the deposit excellent fossils are often to be secured.

Most collectors are tempted to indulge themselves in gathering fossils solely that they may gratify the natural desire to possess curious and interesting objects; but the student I have in mind should gather these remains for the information they may give him as to the past history of the earth, — the history of its physical development as well as the character of its organic life at different periods. As soon as he has begun to collect the fossils, he should turn his attention to the large problems on which they may throw light. The first point should be, to make the collection completely represent the fossils which occur in a particular bed, without commingling them with those from other levels of the strata. From this point of view, before the collections are gathered, a diagramatic section should be made of the locality, which shall show each important layer of the rocks exhibited at that point. Each of these divisions should be numbered, and the fossils so labelled that they may be referred to their particular sites. It requires great pains to secure all the kinds of animals which are found in a particular division of the rocks. It is necessary to search over a great extent of surface along which the beds are exposed. It is often necessary to use the microscope, or at least the hand magnifying glass, in order to see the smaller forms, particularly the young of the various kinds. In many cases the student may to advantage do a little quarrying, in order to extend the surface open to his observation; but in general, by taking advantage of the natural sections, or those made in quarries, railway cuts, and so on, a large surface can be studied.

Supposing that, on a single day of collecting, the student has succeeded in securing a dozen species of fossils, it is almost certain that patient study extending over weeks will give him at least a hundred different kinds from the same set of beds. While certain forms of animals and plants are very common over extended areas, so that every square yard of sand surface or sea bottom would afford one or more specimens of the species, others are very rare, and have to be sought with patience; they may not in number exceed more than one or two on a square mile of area. Therefore patient watching will often reward the inspector with new species, even on the ground which has been the subject of inquiry for a century. When the student has obtained a considerable collection from any one locality, — say, a dozen species or more, — it becomes necessary for his next advance that he should determine the geological age in which the given strata were formed. This he can best accomplish by taking his specimens to some large museum in which collections from all the important sections in the geological record may be found. There, comparing the species he has in hand with those which have received names, and come from known geological horizons, he may quickly determine the age of the beds on his own ground. But in many cases it is inconvenient to do this work; where this is the case, the student may help himself to important results by comparing the forms he has in hand with those figured in Dana's *Manual of Geology*, or, better, in various State Reports. Although these are liable to a certain amount of error, the acute eye can generally determine in an approximate way the geological age of the fossils which are being considered.

Having ascertained in a general way the portion of the geologic section in which his work is carried on, the student may then advantageously begin a class of inquiries which will lead him to problems of great interest. If he has access to a considerable thickness of strata, he will find, in searching for fossils in different parts of the section, that the same species are not found at every point. A form which is plentiful at the base of the series may become rare in the middle, and disappear at the top of it; while other forms come in at first scantily, then more plentifully, until finally they are very abundant. In general, he will observe that these changes in the character of the organic remains is accompanied by a certain alteration in the physical character of the deposits. Exactly such alterations may be found on the sea-floor at the present day. Particular kinds of animals like mud bottoms; others dwell where the sea-floor is limy; yet others find their best conditions on sandy bottoms. At first sight, it may seem to the student, that, when a form disappears from the rocks, it has been destroyed; but a little consideration will show him, that, because the fossil has disappeared on a particular level, it does not necessarily follow that it died out altogether. He will easily see that the disappearance may be explained by migration of the species in the olden time to a new field. Thus at the present day, when geographic change has brought about an alteration in the character of the sediment deposited on a particular part of the sea-floor, the species inhabiting that region may wander elsewhere, to return, it may be, after many years, to their old ground.

It often happens that the student may find evidences of such migration. A particular species may disappear for a while from the field; we may search a hundred feet or more of rocks without finding the least trace of it; finally at a higher level it appears again, in most cases somewhat changed in form, as a result of its wandering over the sea-floor. A thousand generations may have passed during its absence, and in that time the species may have advanced in its structure, or degraded in its character, so as to deserve another specific name. These disappearances and reappearances of organic forms afford many of the most interesting, though they are the least studied, of the problems which the naturalist encounters. If our beginner will but enter upon such inquiries; if he takes pains to ascertain the exact place in a section where a species disappears, and the character of the sediments in which the disappearance takes place; if he will then search for the re-occurrence of the forms at a higher level, noting again the character of the sediments in which it reappears, as well as the alterations of form which have come upon it, — he will be in the forefront of our modern geological inquiries, and may do work of utmost importance to the advance of science.

There is another opportunity of importance which the observer of fossils has open to him. Every organic form undergoes a series of metamorphoses leading from its condition in the egg or seed to its adult form. As yet, the life history of very few fossils has been made the subject of study, though the inquiry can often be carried on with great ease. When the student has gathered a few hundred specimens of one species, he will observe that these forms are of diverse sizes. On close examination, he will commonly find that these sizes fall into groups which represent the successive periods of growth of the animal, probably the successive annual stages of its increment. If this determination can be made, he then knows how many years the form took from its smallest to its largest size. He then should begin to search for the smaller specimens, which indicate the more infantile steps of development. In this search it is necessary to take great care, and the results will in most cases justify the pains. The student must in all cases expect difficulty in tracing the younger stages of the form he is seeking to inquire into, for the reason, that, when very small, most animals are very frail, and very likely to be destroyed by accident. With patience, however, very remarkable results can be attained in this inquiry; and all such results are of great importance to geologic science, or at least to that branch of the science which is termed paleontology.

If the student wishes to carry his work farther than the resources of his field will enable him to do, he should then proceed, by the aid of books, to trace the life history of the various organic fossils he has encountered in the period of their earlier and later development. To accomplish this task requires considerable access to books; and, in general, it may be said that the ordinary observer cannot afford to undertake this labor save in the case of very few varieties of his fossils. Taking, however, a half-dozen kinds which are best represented in his collections, or which have in any way the most excited his interest, the student may then, through a correspondence with persons who are particularly learned in such inquiries, or by a resort in his excursions to great museums, be able to trace the history of the forms as far as it is known to science.

Most collectors limit their labor to the accumulation of great stores of specimens brought together without much judgment, or at least without any distinct intellectual object. This indulgence in the motive of acquisition cannot be commended to young students. Although the pleasure derived from gathering a great quantity of specimens is distinct, such collections soon become an incumbrance, and often lead to the abandonment of the task. The aim of the student should be, never to take a specimen, save for purposes of exchange or gift to others, except it show him something about the creature which is not exhibited in the collections already in his possession. If he will ask himself the question, What is new in this specimen? What is better exhibited than I have it already shown in my collections? he will save himself a great deal of labor, and give an intellectual quality to his work. His aim should be completely to represent in all stages of its growth, and in every feature, each species which occurs in the district under inquiry.

To effect this complete representation of species, it is desirable that the student should spend a good deal of house time in carefully taking out from the matrix of stone the delicate parts of fossils which are almost certain to be lost when they are freed from the rock by natural means or by the blows of the hammer. The true naturalist will find no task more charming for the idle hours of winter than that of disclosing the creatures which have been hidden in the rock from ancient geologic times. The most ordinary tools and a little patience will accomplish wonders in this way, The student at every stage in his work should be aided by the microscope; he will also find in many cases a little muriatic acid dissolved in three or four times its bulk of water will help his work, though it is by no means indispensable to it, and, indeed, is sometimes harmful to the fossils by destroying the fine details of their structure. This work of excavation should be carried on by the aid of the simple magnifying glass; one which enlarges three or four diameters is best for the purpose. It is necessary that this glass should be large enough to enable the workman to guide the point of his instrument by it. It is also very desirable to have drawings made as the work of excavation progresses, so that, in case of the frequent accidents

which beset this kind of research, the student may have some record of his discoveries.

The great charm of all studies in the ancient life arises from the fact that we readily attain to a certain sympathetic interest in these creatures which are recorded to us in fossils. We see in them our predecessors in the inheritance of the earth. We trace in them, it may be, the first stages of that life which we inherit in our own frames. While the lessons obtainable from fossils are not as varied as those which are gained from the study of the physical part of the earth's mechanism, they have their own peculiar enlarging power. It is not well for the student to limit himself to either of these lines of inquiry, the organic or the physical. The problem of our earth is one. It should not be divided further than is necessary for our understanding of it. A student who considers the world at once as a physical mechanism and as the theatre upon which organic life has played and is playing its wonderful part, gains a larger understanding of life than he can from any narrower field of inquiry.

[Original in *Popular Science News.*]

WEATHER LUNACIES.

BY FREDERIC A. FERNALD.

II.

According to a contributor to "Notes and Queries," there is a belief, very prevalent amongst seafaring men at Ulceby, on the Lincolnshire coast, that when a large star or a planet is seen near the moon, or, as they express it, "a big star is dogging the moon," wild weather is sure to follow. Some of the old sailors claim that they have verified this prediction by a long course of observation. Another contributor to the same journal, writing from Torquay, says, "Some years ago an old fisherman of this place told me, on the morning next after a violent gale, that he had foreseen the storm for some time, as he had observed one star ahead of the moon, towing her; and another astern, chasing her. 'I know'd 'twas coming, safe enough.'" The moon was simply in apparent proximity to two stars, but the old Devonian thought trouble was brewing.

In England, the country-people say, that to see "the old moon in the arms of the new one" is a sign of fine weather; but in Scotland, when the new moon is seen "wi' the auld moon in her arm," it is thought to forebode bad weather. In the ballad of *Sir Patrick Spens* we read: —

> "Oh, ever alack! my master dear,
> I fear a deadly storm:
> I saw the new moon late yestreen,
> Wi' the auld moon in her arm;
> And if ye gang to sea, maister,
> I fear we'll suffer harm."

The late Lord Iddesleigh once used this lunar notion to adorn a political speech. Speaking in Aberdeen, Sept. 22, 1885, he likened the leaders of the opposing party to the old and new moon. "What signs of bad weather are there which sometimes you notice when storms are coming on? It always seems to me that the worst sign of bad weather is when you see what is called the new moon with the old moon in its arms. I have no doubt that many of you Aberdeen men have read the fine old ballad of *Sir Patrick Spens*, who was drowned some twenty or thirty miles off the coast of Aberdeen. In that ballad he was cautioned not to go to sea, because his faithful and weather-wise attendant had noticed the new moon with the old moon in its lap. I think, myself, that that is a very dangerous sign; and when I see Mr. Chamberlain, the new moon, with Mr. Gladstone, the old one, in his arms, I think it is time to look out for squally weather." The reader must have noticed, that, while the new moon's crescent is small, the rest of the disk, although not lighted by the sun, is also dimly visible. This dark surface, partly embraced by the crescent, is what is meant by the old moon in the arms of the new. The light that enables us to see it is reflected from the earth, which, of course, reflects sunlight, as the moon does. When it is a little past new moon on the earth, it is a little past "full earth" on the moon. As the earth wanes, the phenomenon disappears. At first sight, many would say that they saw only the outline of the dark part. The outline appears brightest merely by contrast with the dark sky against it. Now, unless clouds prevent, this phenomenon is *always* seen while the moon is young, and again when the waning moon has become sickle-shaped. It is consequently followed, in different months, by all sorts of weather; and the absurdity of basing any prognostication upon it is obvious.

It has been observed, that clear, moonlit nights are, as a rule, colder than cloudy nights; and in trying to account for this, vulgar wisdom has gone astray, and conceived the idea that the moon itself actually abstracts heat from the earth. The clear nights are cold because the earth, not being covered by a blanket of clouds, loses its heat rapidly by radiation into space. The cold accompanying bright nights probably causes the illnesses for which, in some places, the moonlight is blamed. Although earlier attempts had failed, Melloni, in 1846, with the thermopile and galvanometer, demonstrated that heat reaches the surface of the earth from the moon. Later, Lord Rosse took up this subject, and found that the heat received from the moon increased as the moon waxed, and decreased as the moon waned. Not all of the heat sent earthward from the moon reaches the earth's surface. A part is absorbed while passing through our atmosphere, and is thought by some astronomers to do work in evaporating clouds. It has been indorsed for a meteorological fact by Humboldt, Arago, and Herschel, that the full moon frequently clears the sky. But more of this effect is popularly ascribed to the moon than should be; for the moon frequently *shows* a night to be clear, when, if there were only starlight, its clearness would not be realized. Arago found, by a long series of comparisons, that slightly less rain fell near full than near new moon. This would be the natural result of the evaporation of the clouds. "As for any other influence of the moon on the weather," says Herschel, "we have no decisive evidence in its favor." Professor Newcomb of Washington deems it extremely improbable that the moon disperses clouds, because the sun has not much effect in that way, and the moon sends us only a two hundred and eighty thousandth as much heat as the sun.

It is a quite general belief that a hazy moon foretells an atmospheric disturbance. At Whitby, an English seaport, when the moon is surrounded by a halo, with watery clouds, the seamen say that there will be a change of weather, for the "moon-dogs" are about. The Scotch farmers have this maxim: —

> "If the moon shows like a silver shield,
> You need not be afraid to reap your field;
> But if she rises haloed round,
> Soon we'll tread on deluged ground."

According to another saying, a mist forebodes rain only with the new moon: —

> "An old moon in a mist
> Is worth gold in a kist [chest];
> But a new moon's mist
> Will never lack thirst."

They say in Cornwall, that —

> "A fog and a small moon
> Bring an easterly wind soon,"

where the east wind is a dry one. It is a current sign in New England, that "a ring round the moon" indicates a coming storm; and we sometimes hear, also, that the number of stars seen within the ring shows how many days will pass before the storm comes. The halo is really a weather-sign, to be trusted. It is due to the refraction of the moon's rays within our atmosphere by mist or ice-crystals, which may be expected soon to fall, as rain or snow. The larger the halo, the lower the mist hangs, and the sooner may the storm be expected. If the number of stars within the ring were any indication, a large halo would signify a distant storm. But what makes this sign ridiculous is, that the number of stars may be seen to vary from hour to hour of the same night.

Several prominent scientists have taken occasion in their works to deny any lunar influence on the weather. Thus, Professor Newcomb says: "A striking illustration of the fallibility of the human judgment, when not disciplined by scientific training, is afforded by the opinions which have at various times obtained currency respecting a supposed influence of the moon on the weather. Neither in the reason of the case nor in observations do we find any real support for such a theory. It must, however, be admitted, that opinions of this character are not confined to the uneducated." Mr. Edward B. Tylor, in his *Primitive Culture*, makes similar comments: "The notion that the weather changes with the moon's quarterings is still held with great vigor in England. That educated people, to whom exact weather records are accessible, should still find satisfaction in the fanciful lunar rule, is an interesting case of intellectual survival." It might be hard to establish cases in which the belief in false weather-signs had done specific damage, although such cases could easily be imagined. Still, it is the duty of science to combat superstition, wherever found; for the holding of irrational beliefs unfits the mind for receiving truth when rationally presented.

[Original in *Popular Science News.*]

STRAY LUNAGRAPHS.

The moon looks red when it is eclipsed, because it is then faintly illuminated by sunlight shining around the edges of the earth, which has lost its blue and violet rays in traversing our vapory atmosphere.

We often hear it said of a moonlight night, that it is nearly as bright as day; but the moon is, in fact, a very insignificant luminary in comparison with the sun, from which it borrows all its light. Various observers estimate that the moon reflects from fifteen to twenty per cent of the light falling upon it. Herschel deemed the moon not much superior to a weathered sandstone as a reflector. "I have frequently, he says, "compared the moon setting behind the gray perpendicular façade of the Table Mountain, illuminated by the sun just risen in the opposite quarter of the horizon, when it has been scarcely distinguishable in brightness from the rock in contact with it." Of course, it is but a very small portion of the light radiated by the sun in all directions which falls upon the moon; and, as we have seen, not more than one-fifth of this incident light is reflected. A careful comparison made by Zollner showed the light of the full moon to be about $\frac{1}{618000}$ of the light of the sun.

The Harvest Moon is the full moon which falls on or near the 21st of September. Its peculiarity is, that it rises more closely after sunset for several nights after the full, than any other full moon in the year. This results in four or five successive nights being almost moon-lit, and the opportunity

thus given for evening work in harvesting has led to this full moon being distinguished by the name Harvest Moon. The difference between the moon's times of rising on successive nights, average about fifty minutes; the greatest difference occurs in the spring, when it may reach an hour and a half. The Harvest Moon may rise over half an hour later each night, while under the most favorable conditions the difference is only about ten minutes.

The moon's orbit makes the least angle with the horizon at the autumn equinox; and in advancing one day's motion along its orbit, the moon becomes less depressed below the horizon than at any other time, and hence has but a little greater hour angle to travel over each succeeding night after sunset, to bring it into view. The full moon following September also rises but little later from night to night, and is called the Hunter's Moon.

Poets and painters, and even such supposedly matter-of-fact people as historians, often take the liberty of bringing the moon upon a scene in any phase they please, without the slightest regard to fact. Thus, in a picture representing an evening scene we find a waning moon, which would be visible only in the morning; or the moon is forced to shine in a historical painting, although the event depicted occurred when the moon was new, and therefore invisible. In Wolfe's ballad on "The Burial of Sir John Moore," it is written that the hero was buried "by the struggling moonbeams' misty light," while in reality the moon was out of sight on that occasion; and a newspaper correspondent during the Franco-Prussian war described the full moon as shining on a scene of desolation on a particular night, when no moon was to be seen. These criticisms are made by Nasmyth and Carpenter, in their work on "The Moon;" and the learned authors furnish, involuntarily, additional evidence that great care is necessary when straying in unfamiliar fields, for they misquote the title of Wolfe's ballad as "The *Death* of Sir John Moore." F.

ATOMS.

A new locality of fossils has been discovered on the borders of Braintree and Quincy, Mass., which produces well-preserved trilobites.

Nine new comets were observed during the year 1886.

The Senate of Pennsylvania has passed a bill providing for the infliction of capital punishment by electricity.

An Australian mineral called maldonite has been found to consist of an alloy of gold and bismuth, containing sixty-four per cent of the former metal.

A gas-well recently bored at Fairmount, Ind., flows nearly twelve million cubic feet per day.

Horses and cows can be protected from flies by sponging them lightly with soap-suds to which has been added a trace of carbolic acid.

According to Professor Vaughn, the discoverer of tyrotoxicon, the poison developed in milk, that substance is identical with di-azobenzol.

Wrought-iron expands and contracts with a force of about two hundred pounds per square inch for each degree Fahrenheit.

The petroleum refiners of the United States are the largest consumers of sulphuric acid in the world, using about nine million pounds per month.

At the National Cat-Show recently held at the Crystal Palace, near London, the prize for weight was taken by a puss of twenty-three pounds. Another gifted feline had white fur, and one blue and one hazel eye.

Fifty thousand tons of soot are taken from the chimneys of London annually. It is valued at two hundred thousand dollars, and is used for fertilizing purposes.

Practical Chemistry and the Arts.

NOVEL PROCESS OF IRON CASTING.

At a recent meeting of the Franklin Institute, Mr. A. E. Outerbridge gave an account of a new process by which the patterns of the most delicate lace-work may be reproduced in solid iron, by casting it directly upon the fabric, which has been previously rendered refractory by carbonization. The cut (from the *Journal* of the Institute) represents a casting in gray iron upon a piece of thin embroidered summer dress-goods, and shows clearly the minutest stitches in the original fabric.

The most important part of the process is the carbonization of the material to be copied. When done as described below, the carbon skeleton remaining possesses properties very different from those of ordinary charcoal. It is hard, tough, can be bent or rolled without breaking, and, when placed in the flame of a Bunsen burner, glows like a platinum wire, without being consumed. To obtain the carbon in this form, the cloth is placed in an iron box, surrounded with powdered charcoal,

and covered with a tightly fitting lid. It is then heated with a gradually increasing temperature till smoke ceases to escape, when it is raised to a white heat, and kept so for at least two hours. After cooling, the cloth is found to be converted into this peculiar graphite-like variety of carbon, and can be placed in a mould filled with common foundry sand, and molten iron run in upon it in the usual way. A perfect reproduction of the pattern in the solid metal is obtained; the fabric is not only entirely uninjured, but it does not even adhere to the iron, and can be stripped off and used over again.

Aside from a cheap and easy method of ornamenting iron, there will doubtless be found many practical applications of the process; among others, a plate of iron thus prepared can be used as a die for embossing or stamping wood, leather, paper, and similar substances.

The process also illustrates the remarkable modifications of which that peculiar element carbon is capable. In the form of charcoal it is broken by a touch, and destroyed by the smallest flame. As graphite, it is the softest mineral known; as the diamond, the hardest: and in this intermediate modification it resists the heat and destructive action of molten iron. Yet it is, as far as we know, always the same elementary substance. Doubtless we have yet much to learn regarding the nature of the so-called elements.

CARBONIC DIOXIDE IN THE ARTS.

Carbonic-dioxide gas was condensed, by pressure and cold, to a liquid, by Faraday in 1823; and in 1835 Thilorier showed that it could be frozen into a snow-like solid. Modern improvements in the condensing apparatus have made it possible to prepare it on a large scale so cheaply that it can be used for many industrial purposes. A company in Berlin now furnish it in iron bottles holding ten quarts of the liquid, equal to about a hundred and ten cubic feet of the gas.

According to *Le Moniteur des Produits Chimiques*, this liquefied gas, by its expansive power, is used for a great variety of purposes. It furnishes a ready means of forcing beer from the casks, in place of the old-fashioned beer-pump, — a use to which the lager-loving Germans have not been slow to apply it. Soda and mineral waters can be quickly and easily charged with the gas from these bottles. At the great iron foundry of Krupp at Essen it has been used to compress the fluid steel in the mould, thus giving greater density and strength to the casting. The Berlin fire engines have been operated by the expansive power of the gas, which is always ready for use without the delay of raising steam; and portable extinguishers can be directly charged with the liquefied gas, instead of producing it from chemicals, as at present.

Solid carbonic dioxide can be made from the liquefied gas by allowing it to escape into a flannel bag. The liquid, as it expands into gas, produces a degree of cold sufficient to freeze a portion of itself; and the bag becomes filled with a flocculent, snow-like substance, which only slowly evaporates in the air. A cube measuring about four inches did not disappear for half an hour; and, by compressing it in a wooden mould, it can be made as hard as chalk, and will evaporate much more slowly than when of the usual density. A compressed cylinder two inches long and an inch and a half in diameter did not disappear completely for five hours.

It must be remembered that this solid carbonic dioxide is extremely cold, — much below the freezing-point of mercury. Nevertheless, it can be handled without freezing the fingers, owing, probably, to the fact that the gas it is constantly giving off prevents the fingers from coming into close contact with the cold solid. It is practically in the *spheroidal state*, like a drop of water on a hot surface.

As the liquid gas becomes better known, other uses will doubtless be found for it. It may be used to drive light machinery, such as sewing-machines, electric-lighting apparatus, small pleasure-boats, etc. For such purposes it has many advantages over steam or gas engines, the only question being that of expense. Probably the manufacture of the condensed gas will be introduced into this country, and many new applications found for this convenient source of power.

PEROXIDE OF HYDROGEN AS A BLEACHING AGENT.

If to a molecule of water (H—O—H) we add another atom of oxygen, we obtain a compound known as peroxide of hydrogen, or oxygenated water (H—O—O—H). Unlike water, this is a very unstable body, and is rapidly decomposed into water and oxygen gas, which is apparently given off as ozone.

Formerly this substance was only made with the greatest difficulty, and was rarely seen outside of a laboratory; but recent improvements in the process of manufacture have rendered it comparatively cheap, and it is now extensively used, not only by physicians as a disinfectant and antiseptic, but also in the arts as a superior bleaching agent.

In the process of bleaching by chlorine gas, it is supposed that the chlorine unites with a molecule of water, forming hydrochloric acid, and setting oxygen free as ozone after the following re-action: $2H-O-H + 2Cl-Cl = 4H-Cl + O_2$. Thus the action is really the same as with peroxide of hydrogen. Unlike chlorine, however, the peroxide has no deleterious effect upon animal fibres like silk or wool, and for this reason is, in some cases, supplanting it. A solution of the peroxide in water is used; and the fabric, previously freed from grease and dirt, is placed in it, and the bath heated to about 80° F. The peroxide is decomposed, and in a short time the fabric is perfectly bleached. Another method consists in saturating the material to be bleached with the peroxide solution, and drying at the above temperature.

In the bleaching of ostrich feathers the peroxide is now used exclusively. The plumes are immersed in the solution for two days, and the subsequent operations of washing and drying must be conducted with the greatest care. Silk, ivory, bone, wax, and hair are also bleached by a similar method.

A solution of this substance has been extensively sold, under the names of "Blondine," "Golden Fluid," etc., for changing dark hair to a golden color. Unfortunately the real effect is to change the color to an unnatural ashy-gray hue, as many ladies have discovered to their great chagrin, — perhaps a merited punishment for their lack of good taste. Since flaxen hair has "gone out of fashion," it is rarely used for this purpose.

HAND-GRENADES.

A popular article in a recent number of *Chambers's Journal*, on the prevention of fires, contains some excellent suggestions concerning hand-grenades. The fact is emphasized, that fires at the start are easily subdued, and that a bucket of water in time is worth a whole duck-pond full later, when the flames are well under way. Buckets of water conveniently disposed are most useful fire appliances, but can hardly be looked upon as a decoration to a dwelling-house. A simple and efficient substitute for water-pails, useful when fires are in their infancy, is found in the hand-grenade, which occupies but little room, and remains filled with water whether looked after or not. The wonderful fire-extinguishing properties of the liquid contained in these high-priced appliances is very properly questioned; and, though undoubtedly the saline solution with which they are filled is somewhat more efficient for the purpose for which they are intended than pure water, there is no reason why a householder should not manufacture his own hand-grenades, and, by so doing, save an unnecessary outlay of money. The hand-grenade solution recommended by our contemporary is a mixture of 19.47 parts common salt, 8.88 parts sal-ammoniac, and 71.66 parts water. It is entirely unnecessary to compound the mixture with any such exactness, as a rough approximation to the proportions given will give practically the same results. Having prepared this solution, the next thing is, to provide suitable receptacles for it, and place them about the house. Ordinary quart bottles are made of too heavy glass, and do not readily break when thrown at a fire; neither are they of suitable shape for the purpose. The glass flasks used by chemists make excellent hand-grenades, for they are of thin glass, and hold just about the right amount of fluid. The principal objection to them is their cost, but the combined cost of such flasks and the solution for filling them is much below the current price of hand-grenades. There are certain kinds of wine-bottles also which might be used advantageously, as the only necessary feature is thinness of glass, so that the grenade will surely break when thrown at a fire. The bottle or flask should, of course, be stoppered; and it were well to cover the corks with sealing-wax, so as to prevent any loss by evaporation. — *Building.*

COLORED GLASS.

Until quite recently but little colored glass, with the exception of common black and amber bottles, was made in this country. Now quite a number of glass-works are engaged in its manufacture exclusively, and at others it forms a large part of the product. Some of the most beautiful colored glass produced in the world, rivalling in depth and richness of coloring, as well as in beauty of design, that from the famous works of Europe, is made at the flint glass-works of the United States.

The coloring materials most largely employed are iron, manganese, copper, cobalt, and gold. These are generally used as oxides, though in some cases, but very rarely, other compounds are used. In addition to the above, arsenic, uranium, chromium, and silver are occasionally employed.

Manganese is used as a colorer chiefly to impart a pink or purple to glass. If, however, the glass so colored remains too long in the furnace, it becomes pale or reddish brown, then yellow, and finally green.

From the oxides of iron all the colors of the spectrum may be produced, and in the order in which they appear in the spectrum. Its primary effect upon glass is to give it a green tinge. Hence, in the manufacture of white glass, sand containing much iron is carefully avoided. What little it does contain — and there is always more or less present — is neutralized by the oxide of manganese. Oxide of iron, however, produces other colors than green. Indeed, the green of this oxide has but little brilliancy; and, when rich emeralds are desired, other materials are used, such as oxide of copper. Iron will produce in enamels, which are only glasses, a fine purplish red, or, under a stronger heat, an orange. If a piece of iron is thrown into the pot of a flint-glass house during the blowing, the glass in its neighborhood will be orange or yellow.

Oxide of copper is chiefly used to produce reds, rubies, and purples in the cheaper kinds of glass. To produce these reds with copper, however, requires skilful manipulation, as they are not all fixed.

The temperature must be kept at the lowest possible point; otherwise, the glass changes to a purple, then to a sky-blue with a tendency to green. A heat between the maximum, which gives a blue, and the minimum, which gives a red, produces a purple.

The finest rubies, reds, purples, violets, etc., are produced by gold. The purple of Cassius (which is a mixture of the oxides of gold and tin) or some similar preparation of gold is used. The coloring power of gold is so great that one part of gold will give a full, rich body of color to from six hundred to a thousand parts of glass. The glass colored with gold can be made to assume a scarlet, carmine, rose, and ruby.

Cobalt gives a blue which is unalterable in any fire. It is also used for some of the finer blacks.

Carbon, usually as powdered cannel-coal, is the coloring-matter chiefly used in the manufacture of black and amber bottles. Plumbago was at one time largely used, and still is to some extent. — *Mineral Resources of the United States.*

BUILDING IN TUNIS.

On speaking to the architect and engineers, and asking them to show me their plans, they at first did not seem to understand what a plan was; when it was explained to them, they declared they had nothing of the sort, and that, in fact, the Moors never made any, previous to commencing a building, but that they built by the eye a certain length of wall, and that, when this had been sufficiently prolonged, another was built at right angles to it, and so on. What is still more remarkable, their arches are also constructed entirely by the eye, and have no framework to support them during the process, which is as follows: A brick, presenting its broad surface to view, is placed with its edge on the buttress where is to commence the spring of the arch; another is made to adhere to it by means of a very strong cement made of a gypsum peculiar to the vicinity of Tunis, which instantly hardens; on this brick is placed another in the same manner, and thus they proceed till the arch is completed. I saw a vault thus made in less than an hour and a half. These arches and vaults when finished are very graceful and correct in their proportions, and nothing can equal their strength and solidity. In building walls, an oblong frame about seven feet long, and as broad as the wall is intended to be, is placed on the foundations, and then filled with mortar and pieces of stone. In a few minutes the frame is removed, and placed in continuation of the line. This method appears to have been adopted in the construction of Carthage. — *Builder and Woodworker.*

RAILROAD NOTES.

Mr. Ruskin, in a recent letter, has expressed his opinion of railways in a brief but most energetic manner. He says: "They are to me the loathsomest form of deviltry now extant; animated and deliberate earthquakes, destructive of all wise social habit or possible natural beauty; carriages of damned souls on the ridges of their own graves!"

The Anchor Brake. — The *Railroad Gazette* proposes the following: To have an anchor to drop from the rear end of the train, and engage with the ties. Provision for preventing the bending of the ties "under the strain brought upon them" might probably be devised as simply as for the axles; and by having a good long spring to ease the shock when the anchor came to a bearing, in addition to the relief which would come from the draw-springs,

of the entire train, a train might easily be brought to a stop within fifteen or twenty feet from an ordinary passenger speed, "if something did not give way." We are afraid, however, that something *would* give way, and should prefer to be at a respectful distance from any train so equipped.

PERSIAN RAILWAYS. — Persia is preparing to follow in the wake of civilized nations by adopting railway communication. We learn that the government has just awarded the concession for constructing the first iron way to a syndicate of Belgian capitalists. The line will run from the capital, Teheran, to the celebrated place of pilgrimage, Shah-Abdul-Azim, a town of ninety thousand inhabitants, and it will be about ten kilometers in length. It is said that this concession has an importance far exceeding any value that can be attached to any single line of rail, as it entitles the Belgian Company to the exclusive right of constructing and working a long line from the Caspian Sea to the Persian Gulf, and supposed to be in the interest of the Russian government.

THE MAIN RAILWAY OF SIBERIA — The works on this great line of communication are reported to be progressing so rapidly that the section between Tekaterinenburg and Tjumen is now practically completed. The general opinion seems to be, that the goods traffic from China and some of the Siberian governments will be sufficient to pay a large dividend on the enormous cost. The Siberian plain, which will be opened out by the new railway, contains no less than a hundred and fifty salt lakes, with a yearly production of seventeen million kilograms of salt. The principle market of Western Siberia is held at Ischim; during its week's duration the turnover reaches the large sum of eight million roubles. Both transport and production have hitherto been hampered by a number of difficulties, but the new Siberian railway line is expected to remove all these. Easier means of transport will naturally tend to develop the trade of the neighboring countries, China and Turkestan; and Siberia may prove an important buyer of machinery, etc., in which direction an enterprising Stockholm firm has recently secured several very fair orders.

RAILWAY LUBRICATION. — A contemporary gives the annual consumption of oil upon the railways of the United Kingdom roughly as follows: Engineer's department, £30,000. Locomotive department: running, £225,000; shops, £25,000; carriage-lighting, £40,000. Traffic department, £40,000; general offices, etc., £10,000. Total estimated cost, £370,000; or, say, at 6*d.* per gallon, 14,800,000 gallons a year. The average cost per train mile of "oil, tallow, and waste" in the locomotive running expenses is .267*d.* per train mile. Oil by itself may be taken at about a fifth of a penny per train mile, which, on a fair aggregate mileage, would give the £225,000 above estimated as the cost in this department on all the lines.

SPEED OF TRAINS. — Professor Dudley is authority for the statement, that after experiments with a train of some twenty-five cars of stone ballast, the tests covering several weeks, it was proven that the most economical speed, as regards fuel, was twenty miles an hour. The fuel consumed was less at twenty miles than at ten miles an hour, and beyond twenty the consumption increased rapidly, but below that slowly; these facts being by no means strange, when it is borne in mind that in one case the engine is under steam twice as long as in the other case. The number of miles run by an engine to the ton of coal consumed used to be the basis for ascertaining the comparative work of locomotives; but with heavier engines and heavier car-loads, and the different conditions on different roads, this rule is now decidedly unreliable and deceptive, and in its stead the tons of freight moved and the tons of coal burned in a given time is suggested.

EASY CHEMICAL EXPERIMENTS.

THE MAGIC BOTTLE. — Into a wine-bottle put some water and enough logwood to bring it to the tint of claret. Prepare four wine-glasses as follows: (1) Cleaned with pure water; (2) containing a few drops of acetic acid; (3) containing a few drops of solution of potash; and (4) containing a small piece of alum. On pouring from the bottle into these glasses, you will have liquids resembling respectively claret, sherry, gin, and port.

CHEMICAL LANDSCAPES. — One of the prettiest and most interesting chemical experiments imaginable is that resulting from immersion of some lump ammon. hydrochlor. into a twenty-five per cent solution of nitrate of lead strongly acidified with nitric acid. Suitable proportions are 2 ounces nitrate of lead, 6 ounces distilled water, ½ ounce nitric acid, and from 2 to 3 drachms of ammon. hydrochlor. The chemical action may be explained as follows: The nitric acid decomposes the hydrochlorate, forming ammonia nitrate, and setting free hydrochloric-acid gas, which, the moment the outer circumference of each minute bubble comes in contact with the lead solution, forms insoluble lead chloride. This is piled up in the most fantastic shapes, hollow stems reaching to the surface of the solution. After a few hours splendid crystals of ammonia nitrate begin to form. The effect is indescribably beautiful. With a little imagination, perfect winter landscapes, ruins, trees, etc., may be made out. The vessel containing the solution should be placed on a mantel-shelf, or some place where it is not likely to get shaken. This is a *sine qua non*. If undisturbed, it will last for days. The cost is almost *nil*.

THE GHASTLY FLAME. — Burn in a saucer half a gill of spirit to which has been added two or three teaspoonfuls of salt and a pinch of saffron. Put out all other lights, and the faces of the company assembled round the small caldron will assume a ghastly aspect. — *Chemist and Druggist.*

PRACTICAL RECIPES.

HARD PUTTY. — The *Carriage Monthly* gives the following for a hard putty that will dry in one day: Take the whitening, mash all the lumps out on the stone, and mix it into a stiff paste by adding equal parts of japan and rubbing varnish; then add as much keg-lead as you think will make it work free with the knife; then add the rest of the whitening until you have it to suit you. This will sand-paper well with one day's drying. If you want putty that will dry quicker, take dry white lead, and mix with equal parts of japan and varnish, to which add a few drops of turpentine. This is very soft for putty, but can be sand-papered in from two to three hours, becoming perfectly hard in that time.

CEMENT FOR MINERALS, ETC. — Professor R. F. Whitfield recommends the following, which is said to be used by the United States Government for gumming postage-stamps. It has the properties of being very adhesive, does not become brittle or scale off, and is well adapted to stick paper labels to tin and other metals: Take of starch, 2 drachms; white sugar, 1 ounce; gum-arabic, 2 drachms; water, q.s. Dissolve the gum, add the sugar, and boil until the starch is cooked The professor recommends it to be dried into sheets by spreading it out on any material to dry, and re-dissolving it when required for use.

Home, Farm, and Garden.

THE SCIENCE OF THE TEA-KETTLE.

THE boiling of water, although a very common and familiar occurrence, is of much interest from a scientific point of view. In a metallic tea-kettle the operation cannot well be observed; but if we substitute a beaker or flask of thin glass, such as is used by chemists, we can study the process of ebullition very closely.

When the water is first heated, nothing occurs; but as its temperature rises, minute bubbles are given off, accompanied by a simmering noise. These bubbles are not steam, but air which has been dissolved by the water. All ordinary water contains more or less of this dissolved air, which escapes when the temperature is raised. By removing the atmospheric pressure with an air-pump, the air will escape at ordinary temperatures; and, on the other hand, by increasing the pressure, it may be made to dissolve a greater amount, as in the case of ordinary soda-water, which is nothing but water charged with carbonic-acid gas under a high pressure. The familiar "singing" of the tea-kettle is due to this escape of air from the heated water.

If we continue to heat the water, no change will be noticed till it reaches 212° F., when bubbles of steam will begin to form at the bottom of the vessel. At first these will be condensed as they rise into the cooler water above, but in a short time will pass entirely through it, and escape from the surface. In this change of water into steam there has been no change of composition: steam as well as water is made up of hydrogen and oxygen gases. It is a purely *physical* difference; the molecules, or particles, of the water being driven apart by the repulsive force of heat to form steam, like the sudden scattering of a swarm of bees.

Under the usual pressure of the atmosphere water is changed into steam at the temperature given above; but if we reduce this pressure, either artificially or by ascending a mountain, the boiling-point becomes lower. It will fall approximately 1.7° for every 900 feet that we rise from the sea-level, corresponding to a fall of one inch of the barometer, or a reduction of a half-pound of pressure to the square inch. Housekeepers say, that, when the water in the tea-kettle boils away rapidly, it is a sign of rain, and it is true, that, under the low atmospheric pressure which usually precedes a storm, the water would boil at a somewhat lower temperature; but it is doubtful if the difference would be very perceptible. Under an increased pressure, on the contrary, water may be heated far above 212° without boiling. In a boiler in which there is a steam pressure of 105 pounds, the temperature of the boiling water is 339.4°.

If the water contains substances in solution, the boiling-point is raised; if saturated with common salt, for instance, the temperature of the boiling liquid is 228°. If pure water is placed in a smooth glass vessel chemically

clean, it can be heated to 223° before ebullition commences; and M. Deluc found, that when previously freed from the dissolved air, and heated in a glass flask with a long neck, its temperature could be raised to 234°, when it would boil with almost explosive violence. There is no danger of this occurring under ordinary conditions, as the rough surfaces of the kitchen utensils would always cause the water in them to boil at the standard temperature.

When water once begins to boil, it is impossible to raise its temperature any higher; all excess of heat is absorbed by the escaping steam as so-called latent heat, and is given out again when it condenses.

We often speak of *seeing* the steam escaping from the spout of the kettle, but this is incorrect; steam is an invisible vapor, and we can no more see it than we can air. What we do see are the minute drops of water into which the steam condenses on coming into the cool air. If we boil water in a glass flask, we shall notice that nothing can be seen in the interior; and, by observing the steam escaping from a kettle, we shall notice that there is quite a distance between the end of the spout and the point where the cloud becomes visible. This cloud of steam is of exactly the same nature as the clouds which float in the sky, and are formed by the condensation in the cool upper regions of the steam or aqueous vapor present in the air.

The power of dissolving substances which water possesses is greatly increased by heating to the boiling-point; for this reason hot water is used in making tea or coffee, to extract the stimulating and flavoring substances from the leaf or berry, and in soup-making, where a large proportion of the nutritive elements of the meat enter into solution. In boiling vegetables, the hot water with which they are permeated so acts upon their hard and tough constituents as to render them soft and easy of digestion.

The "fur," or stony substance which is often deposited upon the interior of the kettle, is usually carbonate of lime. This substance is somewhat soluble in water containing carbonic-acid gas, but insoluble in pure water: so, when the water is heated, the carbonic-acid gas is driven off, and the lime salt precipitated. Nearly all "hard" waters contain lime, and the only way to prevent the deposit is to use rain-water for filling the tea-kettle.

SPONTANEOUS COMBUSTION.

Although the majority of fires attributed to spontaneous combustion really originate in some other way, there can be no doubt that a certain proportion are really due to this cause. It therefore behooves every housekeeper to be careful to avoid any accumulation of material which can by any means ignite by itself, and an explanation of the chemical principles involved may be of interest.

Oily rags and waste are perhaps the most dangerous substances on this account, — more especially rags saturated with linseed oil and turpentine, which painters seem to delight in leaving in every corner where they have been at work. These substances, when exposed to the air, will rapidly absorb oxygen, forming other substances, which gives to the paint its "drying" qualities. Now, oxidation is a process always accompanied by heat. If the oil is freely exposed to the air, the heat passes off so quickly that no dangerous rise of temperature can take place: but in a pile of rags the oxidation takes place very rapidly, owing to the large amount of surface exposed; and, the resultant heat being more or less confined in the interior, the temperature may rise so high as to cause the oil-soaked material to ignite, the rapid oxidation of combustion taking the place of the less active process of chemical change in the oil. This spontaneous combustion of oily material is no theoretical occurrence, but has often been experimentally accomplished, and destructive fires have undoubtedly occurred from such a cause.

If we take some spongy or porous platinum, and hold it in a stream of hydrogen gas or in alcohol vapor, it will become red-hot, and ignite the gas. This peculiar phenomenon is probably due to the power possessed by platinum, as well as some other substances, of *condensing* gases in their pores. The hydrogen or alcohol vapor and the atmospheric oxygen are brought into such close contact in the pores of the platinum, that they combine, thus generating heat. Freshly burned charcoal also possesses this property to a considerable degree, and will absorb from ten to twenty times its own volume of oxygen. It is quite conceivable, that, under favorable circumstances, this condensed oxygen might enter into chemical combination with the carbon, and cause it to spontaneously ignite. Add to this the possibility of sparks of fire remaining in the charcoal from the burning, and the wisdom of keeping it in a secure place away from woodwork of any kind is evident. Certain mysterious fires originating near steam or hot-air pipes have been attributed to the partial charring of the wood by the heat, and the condensing power of the charcoal so formed; but this is still an unsettled point, although there is no doubt that fires have occurred which cannot well be explained in any other way.

The spontaneous combustion of the human body is a physiological impossibility. Nearly two-thirds of the body is water; and, leaving out the bones and other incombustible parts, the proportion becomes still greater. It is absurd to suppose that such a water-soaked mass as this could "burn up," either spontaneously or otherwise, without a preliminary desiccation which would destroy life long before the necessary degree of dryness was obtained; and the amount of alcohol which passes into the tissues of the most confirmed inebriate is so very small, that it would not have the slightest effect upon their combustibility. The furnaces which are necessary to successfully cremate a human body are a sufficient proof of the impossibility of any development of the necessary heat in a living person.

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THE MYSTERIES OF PLANT-GROWTH.

BY FRANCIS WYATT, PH.D.

VI.

In a previous chapter I have already explained that every plant, from the most insignificant little weed to the majestic oak, is made up of a combination of the same elements. Of these, we have now reviewed the organic group, — carbon, hydrogen, oxygen, and nitrogen, — and we can therefore proceed to consider those mineral principles which are equally indispensable to plant existence and development.

They are invariably the same, and are ten in number, as follows: —

Phosphorus,	Manganese,
Sulphur,	Calcium,
Chlorine,	Magnesium,
Silicon,	Sodium,
Iron,	Potassium.

The most important of these factors are phosphorus, potassium, and lime; and they will require our particular attention, from the fact, that, while they certainly play the leading part in the functions of vegetation, they are the least prevalent in the soil, and so are most liable to exhaustion. I shall therefore first briefly dispose of the others, and then deal with them at the necessary length.

Silicon is a non-metallic body which exists in the soil, either combined with oxygen as pure silica, or combined with various bases in the form of silicates. The purest variety of silica is the transparent, colorless quartz, known as rock crystal, although ordinary sand appears to have been formed by the disintegration of pure siliceous rocks, its admixture with iron having imparted the yellow or brown color with which we are familiar.

The part played by silica in the operations of nature is chiefly mechanical, and depends upon its great stability under all ordinary conditions. In its combinations with aluminium it constitutes the great bulk of the soil; the metallic body being, like itself, distinguished for its immense abundance in the solid portion of the earth.

With the exception of some rare varieties of cryptogamous plants, neither substance enters into the composition of vegetables or animals in sufficient quantity to warrant us in considering them as necessary components.

One of the oldest rocks which formed the basis of the solid structure of the globe is that known, from its conspicuous granular character, as granite.

It is a mixture, in variable proportions, of quartz, felspar, and mica, colored by the presence of small quantities of the oxides of iron and manganese.

Quartz is pure silica; felspar is a combination of silica with oxide of aluminium and potassium; while mica, so named from its glittering scales, is also a double silicate of alumina and potash, in which the alumina is very frequently displaced by oxide of iron, and the potash by magnesia. By the long-continued action of air and water, granite rock gradually crumbles down, or disintegrates, owing to the concurrence of mechanical and chemical causes. Mechanically, water congeals within its minute pores, and the rock is gradually split by the consequent expansion. Chemically, the carbonic acid contained in the water removes the potash from the felspar and the mica, in the form of carbonate; and the silicate of alumina and the quartz, being at the same time separated, the former and lighter body is washed away from the heavier quartz, and finally deposited as clay.

Arable lands are generally classed according to the nature of their predominating element. Thus,

we have sandy, clayey, and limy soils, and each of these merits a passing comment.

Sandy soils are distinguished by their extreme porosity, and are frequently in such a fine state of division, that in the dry season the least wind will displace and scatter them in all directions. In such cases they are naturally sterile; but, when they are sufficiently moist, they facilitate and encourage the growth of an immense variety of plants of the lower order, which, by their eventual decomposition or putrefaction, form considerable deposits of that valuable substance called humus.

Such soils are more propitious than any others for the development of plants with very delicate or fine roots, such as barley, rye, oats, lucern, lupins, lentils, and potatoes; but they require constant attention, and a large and regular quantity of manure, because their porosity permits them to absorb such an abundance of oxygen, that all their organic matter is rapidly burnt up.

Clayey soils are heavy and compact, and, when they contain more than fifty per cent of pure clay, are onerous to work, and unprofitable to cultivate. It has been fortunately, however, discovered that the addition to them of so small a quantity as two per cent of lime suffices to so entirely change their nature and consistency, by transforming the silicate of alumina into a porous silicate and aluminate of lime, that it is now an easy matter, in districts where lime is cheap and plentiful, to overcome this difficulty. In hot countries or in windy regions, or in districts where the subsoil is of a very permeable character, good clay lands offer great advantages; and although they periodically require the application of large quantities of reconstituents, they possess the faculty of retaining all the precious elements supplied to them, and of storing them up for the use of successive crops. When they contain a proportion of about ten per cent of carbonate of lime, or chalk, they are the best of all soils for the extensive growth of such important plants as wheat, corn, clover, hemp, peas, and beans, and of such trees as the chestnut and the oak.

Limy or purely calcareous, are even lighter than sandy soils; and when, as is sometimes the case, they are very white and dry, they are absolutely barren. Such as these are, however, rarely encountered, for we generally find them mixed with a sufficiency of clay to give them some degree of consistency, and render them available for ordinary purposes. Few soils are entirely devoid of lime, owing to the fact that all rocks contain it in greater or lesser proportion, and because it is transported in immense quantities by waters, in the form of bi-carbonate, and deposited. If it were otherwise, or if, in the absence of lime, other alkaline substances were not forthcoming, the acid principles secreted by all plants could not be saturated, and the inevitable result would be decomposition and death. In its pure form, however, lime is such an extremely strong base, that it is incompatible with life; and hence it is never allowed to exist in the soil, unless it be combined either with carbonic or silicic, or sometimes with sulphuric and nitric, acids.

The general properties of every variety of soil are much influenced by color; those which are white, and hence unable to absorb the solar rays, being invariably cold, whereas those which are dark are warm and fertile. In this regard, both iron and manganese are of undisputed value, for by their transformation into ferric and manganic oxides they produce the deep red or brown so much admired by sagacious farmers. In damp climates or in very moist soils, however, too much iron is apt to become a source of considerable danger, from the fact, that, by the exclusion of air, the *ferric* is reduced, by its affinity for water, into *ferrous* oxide, and in that form exercises a highly corrosive action on vegetable life.

In 1669 the German alchemist Brandt, while in search for the "Philosopher's Stone," or, in other words, for that elixir which was to bestow on its discoverer the secret of everlasting youth and beauty, stumbled across a very remarkable body of a whitish-yellow color, transparent to the eye, unctuous to the touch, and spontaneously inflammable in the air. He called it phosphorus, and took its name from two Greek words, —*phos*, "light," and *phero*, "I carry," because of the luminosity of its vapors in the dark; and we are told that it was long regarded by the ignorant as "the Devil's plaything."

The relations of this wonderful substance to the nourishment and growth of plants are so important that they will be considered separately in next month's issue.

A VINEYARD FOR SALE.

ONE of the best-known of the French vineyards — the famous Clos-Vougeot — is to be sold by auction one of these days. It is only a plot of a little over a hundred acres; but, as every one knows, the product which it yields heads the list of the great Burgundy vintages, which is equivalent, in the opinion of many, to saying that it is the first wine in the world. As the French owe their choicest liquor to the Carthusians, so they owe their finest Burgundy to the Cistercians; for it was they who, in the twelfth century, first planted the grape which produces it, and from which it has taken its name. It soon acquired a European reputation. A hogshead of the generous *cru* was a gift for a king. Jean de Bussieres, one of the priors of the order, received a red hat from Gregory XI. in exchange for thirty casks of the wine, —a tithe of one year's produce. The yield rose to seven hundred casks in 1835, but it does not average more than about half that quantity. The upset price of this highly flavored patch is fixed at $240,000.— *Am. Analyst.*

THE FARMHOUSE CELLAR AS A BREEDER OF DISEASES.

As a breeder of diseases, there are few things that excel the average farmhouse cellar. It underlies the whole house, with nothing to prevent its exhalations rising into the upper rooms except a thin board floor. In this cellar all manner of things for family use are kept the season round. Meat, vegetables, milk, butter, bread, pastry, preserves, pickles, and fruit are here stored in their various receptacles. There is very seldom any thing to separate the fruit and vegetables from the other parts of the cellar, and there is usually more or less decaying vegetable matter to load the air with poisonous germs. At various seasons of the year the cellar walls collect dampness, or small pools of water lie under their loose board floors, sending up malarious odors into the rooms above. — *Manufacturer and Builder.*

SELECTED RECIPES.

SWEETBREAD CROQUETTES. — Prepare and parboil a pan of sweetbreads, and chop them very fine. Let one-half cupful of cream or milk come to a boil, and then add to it one tablespoonful of butter and two tablespoonfuls flour which have been rubbed together, and stir constantly till the mixture is thick. Take from the fire, and add the sweetbreads, a pinch of nutmeg, one of pepper, a taste of onion-juice, and a tablespoonful of parsley. When cold, form into croquettes, dip into egg and cracker crumbs, and fry. Serve with peas.

CHICKEN CONSOMMÉ. — Clean, draw, and truss a pair of old fowls, and roast them in a hot oven until they are browned or about half-cooked; then put them into a soup-pot, and cover them with cold water. Season with salt, pepper, a blade or two of mace, a bunch or two of sweet herbs, a sprig or two of parsley, and a bay-leaf. Set the pot on the fire, and boil slowly until the fowls are well done and the broth is reduced one-third. Then take out the fowls, and strain the broth through a fine sieve, and serve it with croutons of toasted bread. The fowls may be served as a second course with oyster sauce.

CURRIED EGGS. — Boil three eggs twenty minutes, then remove the shells, and cut into slices. Fry a bit of onion in a little butter, and add a teaspoonful of corn-starch mixed with a saltspoonful of curry-powder; pour on slowly three-quarters of a cupful of milk, seasoning with salt and butter to taste, and simmer until the onion is soft. Add the eggs, and serve when they are thoroughly heated.

CHEESE-CAKE. — Mix a quarter of a pound of grated cheese, one after-dinner cupful of milk, a little red pepper, nutmeg, salt, and parsley; to this add three beaten eggs. Then grease the baking-tin, and bake the compound ten minutes in a hot oven. This is a very nice dish for either breakfast or supper.

POTATO-CAKE. — Boil and mash the potatoes, working in salt and butter, and an egg or two beaten light. Let them get cold; make into cakes of size and shape to suit yourself. Roll in raw egg, then in flour or cracker dust, and fry quickly in hot dripping. Take each up as soon as it is done, and drain with a wire spoon before laying upon a hot dish.

CORN SOUP. — Grate 12 ears of corn. Boil cobs in 1 quart of water for an hour and a half; remove the cobs, put in the corn, and boil half an hour. Add 1 quart new milk, 1 tablespoonful of butter. Salt and pepper to taste. When ready to serve, add 3 well-beaten eggs. Stir briskly, and do not return to the fire, but serve quickly.

VEGETABLE SALAD. — This is made of lettuce, sliced cucumbers, and tomatoes. Garnish with parsley. Arrange the lettuce-leaves in cup-shapes; lay slices of cucumbers in them, and the tomato in the centre; then put a spoonful of the dressing on the tomato. This makes a handsome and delicious salad. — *Am. Analyst.*

HOUSEHOLD HINTS.

To remove the tops of fruit-jars that cannot be started by hand, dip a cloth in very hot water, and apply to the outside of the cap; this will cause it to expand.

A CARELESSLY kept coffee-pot will impart a rank flavor to the strongest infusion of the best Java. Wash the coffee-pot thoroughly every day.

TO PRESERVE FLOWERS. — Cut flowers may be preserved fresh, according to the *Scientific American*, for a long time in the following manner: Get a glass shade, and place it on a non-porous vessel to form a stand; put water round the bottom to keep the shade air-tight; then procure fresh-cut blossoms, put them in the water immediately, drop into the water in which the flowers are placed a small quantity of spirit of chloroform, and place the shade over them at once. The flowers thus treated, some writer says, will keep fresh for months, but one should hardly expect they would be in a very fresh condition after their four weeks' confinement. Care should be taken to have all in readiness. As soon as the chloroform is put in, place the shade over them, and keep water always round the bottom. A large soup-plate would do for this.

The Popular Science News.

BOSTON, AUGUST 1, 1887.

JAMES R. NICHOLS, M.D.
WILLIAM J. ROLFE, A.M. } . . . . . *Editors.*
AUSTIN P. NICHOLS, S.B.

As an extra inducement to new subscribers, the publishers of the Science News *have decided to offer the remaining numbers of the present year, and all of those for 1888, for the sum of $1.25 to all* new *subscribers.*

The meeting of the American Association for the Advancement of Science, at New York on the 10th of this month, promises to be one of the most largely attended and successful sessions that has taken place for several years. The buildings of Columbia College have been placed at the disposal of the Association, and all the different scientific societies and institutions in the city and vicinity will co-operate to forward the arrangements for the meeting. The address of Professor Putnam, the permanent secretary, will be at Salem, Mass., up to Aug. 6, afterwards at Columbia College, New-York City. All letters of inquiry concerning membership, etc., should be addressed to him.

A European scientist, M. Thore, has described the action of a supposed "new force," the existence of which he demonstrates as follows: he suspends a small cylinder of ivory by a fibre of cocoon silk, forming a small pendulum, which hangs freely over the centre of a table. The cylinder having become motionless, he brings a second cylinder, called the "pillar," about a millimeter from the first cylinder, when the latter begins to rotate clockwise if the pillar is on the left, and counter clockwise if the pillar is on the right of the cylinder. The observer is supposed to face the cylinder and pillar. M. Thore says that the rotation is independent of the nature of the cylinders, of their mass, or the dimensions of the pillar; light, heat, electricity, magnetism, gravity, and air-currents, he says, are also inadequate to explain the phenomenon, which he considers to be due to some inherent force in the human organism. Mr. William Crookes, however, who has investigated the matter very thoroughly, considers that it is simply due to the radiations of heat from the body of the observer, and finds that a bottle of hot water will cause the cylinder to rotate equally well. He thinks that the principle of the apparatus may be the same as that of the radiometer, where similar movements take place in a vacuum. Mr. Crookes admits that he is unable to explain all the phenomena exhibited by the rotating cylinders, but disagrees entirely with M. Thore in considering that any unknown force emanating from the human body is necessary to explain their movements.

Dr. B. W. Richardson of England, in making some investigations upon the physiological effects of breathing pure oxygen by various animals, has discovered, that, by simply passing the gas a few times through the lungs, it becomes "devitalized," or incapable of supporting life, although its chemical composition remains the same, and all carbonic dioxide and other impurities are removed. He also found, that, by passing electric sparks through the gas, it became "revitalized," and regained its usual stimulating effect upon the animal economy. The devitalized oxygen would still support life in cold-blooded animals, and combustible bodies would burn in it as brilliantly as ever. Dr. Richardson considers, that while the gas is in contact with the tissues or blood of a warm-blooded animal, some quality essential to its life-supporting power is lost. The subject is an interesting and important one, and deserves a more thorough investigation, which we presume will be given to it.

If this "devitalizing" theory is confirmed, of which we have some doubts, it may explain the peculiar effects which certain winds and meteorological conditions have upon the human constitution. The peculiar sensitiveness of certain persons to easterly winds is well known, and the depression produced by a hot south-west wind, in New England, is in marked contrast to the brisk exhilaration experienced when the north-west wind blows, although the temperature may not be very much lower. It may prove that the percentage of devitalized oxygen is the cause of the difference. The effect of a thunderstorm in clearing the air may also be found to be due to the revitalizing power of the sparks from Nature's great electrical machine.

The editors of *Science* have been making an investigation as to the healthfulness of the milk produced by cows fed upon the waste from distilleries. Reports have been furnished them by the leading physicians and sanitarians of the country, which display a most remarkable difference of opinion. While the majority consider "distillery-swill" as utterly unfit for food, and the milk produced by cows fed upon it as dangerous to use, others whose opinion is equally authoritative claim that cows so fed continue in good condition, and produce nutritious and wholesome milk. They consider, that, when the cows show evidence of disease, it is due to the crowded and unsanitary conditions likely to prevail in city stables. Although we can hardly believe that cows fed upon such unnatural food can remain long in a healthful condition or produce good milk, yet the reports referred to are of much interest as showing the difference of opinion which prevails upon matters of every-day observation among the highest authorities.

In Boston as well as many other large cities the pueblo-like apartment-house is rapidly supplanting the old system of separate dwellings. On all the desirable building sites these great eight or ten story buildings rise into the air; and the demand for their contracted and uncomfortable "flats," at exorbitant rents, is far beyond the supply. A large and crowded city is a very undesirable place of residence, both on account of sanitary and social conditions, and we are glad to note the increasing number of suburban homes within a convenient railroad distance of the city. Still, we suppose a large proportion of the population will continue to live within metropolitan limits; and the residence of the future inhabitant of Boston or New York bids fair to revert to the type adopted so many years ago by the prehistoric natives of New Mexico and Arizona.

SHAKESPEARE'S ASTRONOMY.

There are not a few astronomical allusions in Shakespeare and other writers of the time, which, if interpreted according to our modern science, are intelligible enough, but are, nevertheless, misinterpreted. For instance, when a fairy, in the *Midsummer-Night's Dream* (ii. 1), says, "I do wander everywhere, swifter than the moon's sphere," or when Demetrius in the same play (iii. 2) speaks of "yonder Venus in her glimmering sphere," the meaning we should naturally give to *sphere* — the orb or globe of the moon or Venus — makes a satisfactory sense. In certain other passages, however, the meaning is not so clear at first sight. To take an illustration from the same play: when Oberon says (ii. 1) that "certain stars shot madly *from* their spheres," we are puzzled, unless we take *spheres* to be a poetical equivalent for *orbits;* and so in the *Tempest* (ii. 1), where Gonzalo speaks of "lifting the moon *out of* her sphere."

The fact, however, is, that *sphere* in these and other passages of Shakespeare does not mean orb or orbit in the sense in which we now understand the words, but is to be explained in accordance with the Ptolemaic system of astronomy as generally accepted in the Elizabethan age. And this system, we may add, is very imperfectly described in the school manuals of astronomy — if they refer to it at all — and the popular books on the subject; the particular feature of which the dramatist and other poets make frequent use being invariably omitted altogether.

The majority of intelligent people know that the Ptolemaic astronomy placed the earth in the centre of the universe, with the heavenly bodies revolving about it every twenty-four hours in the following order: the Moon, Mercury, Venus, the Sun, Mars, Jupiter, Saturn, and the fixed stars. The "seven planets," so often mentioned by old writers, were the seven bodies moving inside the orbit of the fixed stars; these latter being supposed to be all at the same distance from the earth.

But these heavenly bodies were *not* supposed to travel, as we now know they do, through empty space. They were assumed to be set in eight hollow, concentric *spheres* of transparent crystal; and these spheres revolved, carrying the shining orbs with them. The spheres were in contact, and each depended for its motive-power upon the motion of the next sphere outside itself. As the system was

understood in Shakespeare's day, the outermost of these eight spheres derived its motion from a ninth sphere, called the *primum mobile*, which had no other purpose except to communicate its inherent motive-force to the others. Subsequently a tenth sphere, the Empyreal Heaven, was added. This was exempt from motion, and was the abode of God, with the angels and blessed spirits, — a theological rather than an astronomical addition to the system.

As the reader is aware, the science of that day taught that all created things were composed of the four elements, fire, air, earth, and water. The space between the earth and the nearest crystalline sphere, or that of the moon, was supposed to be occupied by the other three elements, — air, water, and fire. This feature of the system, however, is not often referred to by the poets.

There were various modifications of the Ptolemaic theory which it is impossible to describe in a brief article like this. We may barely refer to one, according to which a sphere was introduced between the ninth and tenth already mentioned. This was a "watery" sphere, representing the "waters above the firmament" of Gen. i. 7. It was created, according to a scientific compendium of 1613, "to the ende that it might mitigate the great heat which the other Heavens acquired by their motion, and by the Stars being in them." The same work says of the *primum mobile*, that "his office is, to turne it selfe [spherically] from the East to the West, by the South, which he dooth in foure and twenty houres; and by his strength and great velocity, he maketh all the other subjacent Heavens to turne about."

The ancient Pythagorean doctrine of the "music of the spheres" was incorporated into this Ptolemaic system. The celestial harmony to which the poets allude in some of the most beautiful passages in all literature, was due to the friction of the crystalline spheres upon one another. The book from which we have already quoted states the matter in plain prose, thus: "Wise men tel, that of meeting of rondnesses [that is, from the contact of spherical surfaces] and of contrary moving of Planets commeth a sweet harmony," etc.

Shakespeare nowhere states the *number* of spheres as he understood them; and his references to the system are all of a more general character than those of Milton, who, as a learned man, — which Shakespeare was not, — had a scientific acquaintance with the subject. In one of the finest stanzas of the *Hymn on the Nativity* Milton distinctly recognizes the nine astronomical spheres, and at the same time refers to the divine music they make: —

"Ring out, ye crystal spheres!
Once bless our human ears,
If ye have power to touch our senses so;
And let your silver chime
Move in melodious time,
And let the bass of heaven's deep organ blow;
And with your *ninefold* harmony
Make up full consort to the angelic symphony."

[*Consort*, often altered to *concert*, a word not often found in Milton's verse, means companionship.]

In his poem *On the Death of a Fair Infant* Milton alludes to the *primum mobile* as "that high first-moving sphere."

A few of Shakespeare's allusions to the Ptolemaic spheres may be added without comment, as we have already given more space to the matter than we intended.

In *Romeo and Juliet* (ii. 2) the hero says of the lady: —

"Two of the fairest stars in all the heaven,
Having some business, do entreat her eyes
To twinkle in their spheres till they return."

In *King John* (v. 7) we have an apostrophe to "you stars, that move in your right spheres." In *1 Henry IV.* (v. 4) we are told that "two stars [meaning planets, not fixed stars] keep not their motion in one sphere." In *Hamlet* (iv. 7) we find the simile, "as the star moves not but in his sphere." In *Antony and Cleopatra* (iii. 13) Antony says: —

"When my good stars, that were my former guides,
Have empty left their orbs" [that is, spheres];

and in the same play (iv. 15), after the death of Antony, Cleopatra exclaims: —

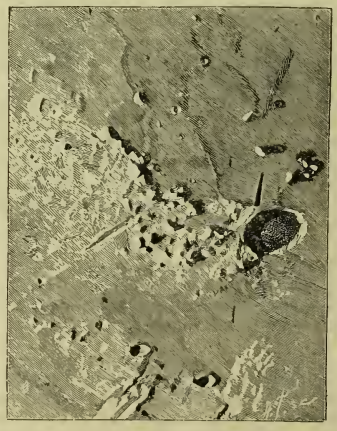
"O sun,
Burn the great sphere thou mov'st in!"

The *astronomy* of Shakespeare suggests the *astrology* of the time to which he has many references, though we are not sure that he believed in it, as the most learned men among his contemporaries certainly did. This may possibly be the subject of another familiar article hereafter.

The reader who wishes to look further into the astronomy of Shakespeare, Milton, and their contemporaries, may be referred to an interesting paper by Dr. F. J. Furnivall in the *Transactions of the New Shakspere Society for 1877–79* (pp. 431–450), and to Masson's larger edition of Milton, vol. i. pp. 89–96 and elsewhere.

CELESTIAL PHOTOGRAPHY.

WE copy from *La Nature* an engraving taken from a photograph of a portion of the



moon's surface in the neighborhood of the crater Plato. It is one of a series of fifteen, taken by the brothers Henry at the Paris Observatory, covering the entire disk of the moon. The telescope used was arranged to largely magnify the image; so that, if the whole disk of the moon had been projected on the photographic plate, it would have had a diameter of nearly two feet. Notwithstanding this amplification, an exposure of twelve seconds was sufficient to produce the picture.

At the time when this picture was taken, to an observer on the moon the sun would appear to be just rising; and this is beautifully shown in the photograph by the long shadows cast by the cliffs and mountains stretching across the plains. The appearance of relief is thus quite evident, and the extinct volcanic craters, or depressions, are readily distinguished from the mountains. The sharply defined edges of these shadows are a proof of the absence of an atmosphere of any density, which, if present, would so disperse the light as to render them indistinct. The height or depth of the mountains or craters can also be determined by the length of the shadow.

With the constantly increasing power of modern telescopes, new features upon the surface of our satellite are being continually discovered; and the improvements in photography enable us to fix and preserve the most favorable glimpses of her surface, to be examined at leisure. When the new photographic objectglass for the great Lick telescope is completed, we may expect even more wonderful revelations concerning our nearest celestial neighbor.

An international congress of astronomers was recently held at Paris, and a plan was arranged for making a photographic map of the entire heavens, as a basis of comparison in the years to come. Nearly two thousand separate plates will be required, and the work is to be distributed among various observatories in both hemispheres. Several years will be required to complete the work, which, when finished, will be invaluable. The photographic plate is so sensitive, that five thousand stars have been photographed in a region where only a hundred and seventy could be seen by the eye. If the numerous problems regarding the distance and motion of the fixed stars, and the proper motion of the solar system through space, are ever to be solved, it is more than likely that it will be done by the aid furnished by stellar photography.

A MINIATURE BALLOON.

IF an ordinary tobacco-pipe is attached by a rubber tube to a gas-burner, soap-bubbles may be blown which will rapidly ascend in the air, and, if touched with a lighted candle, will disappear in a burst of flame. A correspondent of *La Nature* shows how the experiment can be varied in an instructive and amusing manner.

The bubbles are blown from a tube about seven-eighths of an inch in diameter, — somewhat larger than the usual pipe. The tube is preferably of glass, but one made by rolling

up a stiff sheet of paper will answer for a short time. With such a tube, unusually large bubbles can be blown. Before releasing the bubble from the tube, it should be turned vertically upward, so that the small drop which usually forms at the bottom of the bubble may run back into the tube. Then, if the bubble be shaken off, it will rise gracefully, provided the surrounding air is sufficiently cool; the warm air from the lungs with which it is filled causing it to ascend like the hot-air balloons first invented.

The "balloon" can also be provided with an aeronaut by cutting a small human figure out of tissue-paper, and attaching it by a fine thread to a little paper disk, which, by careful

management, may be made to adhere to the surface of the bubble without bursting it.

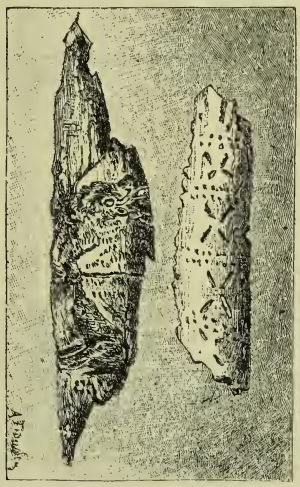
The following recipe will make a very superior soap-bubble mixture. Take shavings of pure castile soap, place them in a bottle, and fill with warm water. Shake occasionally for a few hours, and allow to stand over night. In the morning pour off the clear liquid, and add to it nearly an equal quantity of glycerine. The bubbles blown from this mixture will be of surprising size and beauty.

PREHISTORIC ART.

Among the relics of prehistoric man in Europe, a few specimens have been found which bear evidence of his artistic talent. One of the most celebrated is the drawing of a mammoth on a piece of the animal's tusk, thus indisputably proving the co-existence of man with that now extinct animal.

It is a most curious fact that this artistic ability seems only to have been possessed by the very oldest and rudest tribes of men. The specimens already found have invariably belonged to the palæolithic age, and were probably made by men who lived not long after the glacial epoch, if, indeed, they were not contemporary with the great age of ice. His mechanical skill, as attested by his rough, unpolished flint and bone implement, was very small, yet he made drawings, and even carvings, of considerable merit; while the neolithic man, who lived many thousand years later, so far as we know never attempted to ornament his beautifully finished stone implements by any representation of animals or plants.

In October last we published an account of an engraved reindeer's horn found at Montgaudier in France; and there has recently been discovered at Marsoulas, in that country, a cavern containing numerous remains of palæolithic man, including the two engraved specimens in the accompanying cut (*La Nature*). Three separate layers containing human remains were found in the cave, separated from each other by layers of gravel and dirt, showing that it had been occupied at three different periods. It was in the middle layer that the two fragments of bone illustrated were found; the first being ornamented with regularly disposed



lines, while the second was engraved with a representation of a musk-ox, beautifully cut, and of considerable artistic merit. The use of these objects is unknown, but they were doubtless highly prized by their owners. Another singular find in this layer was some particles of peroxide of manganese, probably used for tattooing. Many other relics were also found, of the usual palæolithic types.

It is strange that some primeval savage, far back in the early days of the human race, should possess greater artistic talent than many of the most highly educated men of modern times; but it is only an additional illustration of how little we really know about the descent of man, or the nature of that wonderful intellect which seems to pertain to him alone.

[Specially reported for the *Popular Science News* from the Observatory of the College of New Jersey.]

ASTRONOMICAL PHENOMENA FOR AUGUST, 1887.

Eclipses. — There will be two eclipses during the month. The first is a partial eclipse of the Moon, on Aug. 3, invisible in the United States. The second is a total eclipse of the Sun, on Aug. 19. The eclipse will not be seen as total in any part of the western hemisphere, but will be seen as a partial eclipse in Greenland and Alaska. It will be wholly invisible in the United States proper. The path of totality extends from a point a little to the west of Berlin, through Germany, Russia, Siberia, and Japan, and ends in the Pacific Ocean at a point about 175° east of Greenwich. The greatest duration of totality is in Siberia, in the neighborhood of Lake Baikal; but, owing to the difficulty of transporting heavy instruments, very few observing parties will go to Siberia. The duration of totality at any one place where the eclipse will probably be observed will be less than three minutes. Most of the observing parties will be in Russia, not far from the lines of railroad radiating from Moscow, which city is a little to the south of the path of totality. Two parties will go from this country. Professor D. P. Todd of Amherst College will observe the eclipse in Japan, and Professor C. A. Young will take charge of a party which goes to Russia. There are several interesting questions on which it is hoped that observations made during the total eclipse may throw some light. One is, as to the nature and extent of the corona or outer envelope of the Sun, and the possible changes which may take place in it during the hour and a half which elapses between the beginning of totality in Germany and Russia, and the end of totality in Japan. Another question of great interest will be the extent and character of the chromosphere, and the still narrower stratum at its base, where occurs the reversal of most, if not all, of the Fraunhofer lines of the solar spectrum, according to those who still believe in the "reversing layer." A number of the parties will photograph the corona and its spectrum. There may be some search for an intra-Mercurial planet, but the weight of opinion at present seems to be against the existence of any one large body; and it is generally thought that the matter between Mercury and the Sun is in separate particles, like a meteor swarm, or ring of asteroids.

The Planets. — Mercury is too near the Sun to be easily seen. It reaches its greatest western elongation on Aug. 16, and then rises rather more than an hour before the Sun. Venus, having passed its greatest eastern elongation on July 13, is apparently approaching the Sun. It will be very bright, and can easily be seen by daylight on any clear day; the time of greatest brilliancy being Aug. 15. By the end of the month it will set very soon after the Sun. Mars is a morning star, rising two to three hours before the Sun, and a little to the north. It is gradually growing brighter, but its light is only one-fifteenth of what it will be at opposition. Jupiter is still to be seen in the western sky in the evening, but will be much nearer the horizon than it was in July. It is moving eastward, and away from Spica (*Alpha* Virginis), near which it has been for some months. Saturn is a morning star, rising more than three hours before the Sun at the end of the month. On Aug. 28 there will be a near approach of Saturn and Mars, the latter passing about one and a half diam-

eters of the moon to the north. Uranus is still an evening star, south and east of *Gamma* Virginis, but by the end of the month sets during twilight. Neptune is a morning star, south and east of the Pleiades. M.

[Specially reported for the *Popular Science News.*]

METEOROLOGY FOR JUNE, 1887.

TEMPERATURE.

AVERAGE THERMOMETER.	Lowest.	Highest.	Range.
At 7 A.M.	61.97°	49°	75°	26°
At 2 P.M.	73.63°	53°	88°	35°
At 9 P.M.	62.43°	50°	76°	26°
Whole month	66.01°	49°	88°	39°
Second average	65.12°	49°	88°	39°
Last seventeen Junes	66.78°	61.67°	70.01°	8.34°
Second average	65.96°	60.95°	68.98°	8.03°

The first day of the month was the coolest, with an average of 52½°; and the last day was the warmest, at 79⅔°. The lowest point in the month was 49°, on the first morning; and the highest point, 88°, was on the last noon of the month. This would seem quite natural, but seldom so occurs; for, while Dame Nature is wonderfully exact in all her laws, yet in preparing the weather she has exquisite variety in executing them. The entire month was below the average about three-fourths of a degree. The mercury rose to 80° and upwards six times during the month. There were several sudden changes occasioned by a shifting of the wind to the east, bringing refreshing coolness.

THE SKY.

The face of the sky in 90 observations gave 47 fair, 18 cloudy, 21 overcast, and 4 rainy, — a percentage of 52.2 fair. This is quite low for "lovely June," the average for the last seventeen Junes being 59.7, with extremes of 40.1 and 75.5. It has been over 70 per cent four times during this period, and only twice less than the present June. The number of overcast observations (21) has not been equalled but once, while the average has been only 12.

RAIN.

The amount of rainfall the past month was 2.27 inches, falling chiefly on the 1st and 23d in nearly equal amount, leaving three weeks rainless. Distant thunder was heard on the afternoon of the 22d attended with slight rain, and in greater abundance the day following. The average rainfall of the last nineteen Junes has been 2.80 inches, with extremes of 0, in 1873, and 5.30, in 1875. Since Jan. 1 the amount has been 27.84 inches, while the average for these first six months has been only 24.38.

PRESSURE.

The average barometer the past month was 30.018 inches, with extremes of 29.67, on the 9th, and 30.28, on the 26th and 27th, — a range of 0.61 inch. The average pressure of June in fourteen years has been 29.933, with extremes of 29.845, in 1882, and 30.054, in 1884, reaching 30 inches but twice in the fourteen years. The sum of the daily variations the past month was 4.23 inches, giving an average daily movement of .141 inch. This average during the last fourteen Junes has been .118, with extremes of .058 and .218; the only instance exceeding that of the present June, indicating unusual atmospheric disturbance. The barometric waves were short during the first ten days, but few and long the rest of the month, with a high general range for June.

WINDS.

The direction of the wind in 90 observations gave 7 N., 0 S., 19 E., 17 W., 4 N.E., 12 N.W., 7 S.E., and 24 S.W., — an excess of 8 southerly and 23 westerly over the northerly and easterly, indicating the prevailing direction to have been W. 19° 11′ S. The westerly winds in June for eighteen years have uniformly prevailed over the easterly by an average of 30.12 observations, and the southerly over the northerly, with three exceptions, by an average of 13; indicating the approximate average direction for June to have been W. 23° 21′ S. The longitudinal extremes have been 7 W. and 78 W., — a range of 71 observations; and the latitudinal 18 N. and 51 S., — a range of 69. The relative progressive distance travelled by the wind the past month was 24.35 units, and during the last eighteen Junes 590.4 such units, — an average of 32.80; thus showing more opposite winds the last month than is usual in June.

IN REVIEW.

Briefly, the past month was a near average in temperature, unusually cloudy, yet below the average in the amount of rainfall, which was unequally distributed; the pressure unusually high, with the winds more northerly and easterly than usual.

D. W.

NATICK, *July* 5, 1887.

[Original in *Popular Science News.*]

NATURAL HISTORY NOTES.

BY DR. S. F. LANDREY.

VII.

WHILE I believe, with Mr. Wallace, that in dogs, cats, horses, pigs, and some other animals, the sense of direction is to a degree dependent on the sense of smell, yet crabs, on the authority of Mr. Robert Fox, caught at Lizard Rocks, find their way back from Falmouth, above seven miles from where they were caught. Von Wrangell's party noted with surprise the skill of natives in North Siberia in "keeping a course" through hummocky ice and under incessant changes. But Audubon's wild goose, after imprisonment, "lost his reckoning." It still remains to be noted that bees, ants, and other insects strike "bee-lines" for home after a day of devious wandering in search of food.

The skill of the North-American Indian in following an indistinct trail, or keeping a direction for days together, without "stars or compass," is proverbial. Therefore we believe, with Mr. Darwin, that "some part of the brain is specialized for the function of direction." In the absence of a brain, it may be, for that matter, a single primitive cell or fibre of ganglionic nervous matter, specially endowed or differentiated for the animal's or insect's purpose; subject, of course, to the laws of heterogenity flowing from disease, imprisonment, etc., as in "Audubon's goose." That in some cases, at least, this sense may reside in the antennæ or feelers, is well-nigh proven by the fact that bees and ants, etc., are known to *move* their antennæ in various directions, as if "feeling for their course" in currents of air, before taking a leave for home. In repairing a cat-hole in a cellar wall, a small stone had perhaps a hundred *Oniscus asellus* (isopods), or sow-bugs, adhering to its damp under-surface. I carried it full twenty-five feet away, and brushed them off quickly, the insects falling in every direction; what was my surprise, in less than five minutes, in seeing them take up a straight line of march northward for the hole in the wall! Before starting, it was amusing to see them feeling the air for their course towards home.

THE man who invented mules ought to have been tied, like Mazeppa, to the back of one of his hybrids, and let loose among the cacti and sage brush of the Great West. I never owned but two, and, if forgiven this time, will never own another one. I had often heard about never "swapping horses in the middle of a stream;" but in the midst of a busy season a jackanape from the mountains bantered me for a trade, and I traded a good horse for a good-for-nothing mule and "cash to boot." The saddle used on my large horse hardly touched his body anywhere. The girth was shortened as far as the straps would reach, half a dozen knots tied in the webbing, the blanket eight double, and still two inches to spare. As the feet could be hooked together under him, it was natural enough to conclude the trip would be safe any way. Going two miles south-west was safe travelling. Coming home was the proof of mule ingenuity and "cussedness." Within a mile of town, and in sight of a neighboring farmhouse, a woman stepped out on the porch, presented a six-foot tin dinner-horn, and began to "blow." The mule took a hint, or "stray thought," and started on a sheep-gallop for town. I tried my foot-lock, but failed to connect. On sped the yellow mule faster and faster. I became alarmed, for the loose saddle played freely from side to side. Several men were ahead walking. Calling in a loud voice, I warned them that the mule would not check up. They stepped aside; on came the mule, beating time with his beautiful shaven tail, giving it a "yerrick" every other jump. I said "Good-morning" as I reached the spot where the men were watching the sport. I never heard whether the "cussed" mule said "Good-morning" or not. He stopped; the saddle slid on to his neck; I turned a double somersault over his head, sat down rather suddenly, so to speak; the plug hat went one way, saddle-bags another; and, when I looked up, the mule was still standing in his old *posé*, — head down, and ears still flopping back and forth. My mud photograph was visible for a week.

ON opening a mink soon after it was killed, a sort of progressive wave-motion was observed in the intestines. A closer inspection revealed the fact that a superficial retrograde or upward motion took place after the downward or peristaltic motion. About a half-inch of the intestine was included in the wave, which moved at the rate of about two inches per second; contracting the inner caliber of the intestinal tube very sensibly, in front of each wave, in its downward motion. The wave seemed to recede toward the stomach more rapidly than it moved away from it; but the successive waves were nearly equal to each other in length, going or returning. Whoever has carefully noted the attacks of pain in neuralgias, rheumatisms, inflammations, etc., as well as *efforts at thought*, becomes aware of a sort of sensible interlude, or quiescence, in nerves as well as in muscles. And who has not observed that all odor ceases after smelling musk-plant, heliotrope, etc., two or three sniffs in rapid succession?

[Original in *Popular Science News.*]

THE BAROMETER AND THE WINDS.

BY fourteen years' observation with the barometer, twice daily, I find that September and October are the only months in the year that have reached the general average of 30 inches and upward; while March and April stand the lowest in such average, standing respectively at 29.879° and 29.880° for the fourteen years. September has averaged over 30 inches eleven times in fourteen years, and October seven times; while March has not reached 30 inches, and April but once, during this period. The question arises, Why this difference? What is the cause? I would suggest the following solution: —

If the sun always passed in the celestial equator, its rays would fall equally upon the northern and southern hemispheres, and the torrid atmosphere would correspond with the torrid zone. But, as the sun moves in the ecliptic instead of the celestial equator, it is continually moving more and more northerly, or more and more southerly, every day, carrying the atmospheric torrid zone with it. Six months in the year the majority of this atmosphere is in the northern hemisphere, the other six months in the southern. As the torrid zone is over three thousand miles wide, it embraces about three-eighths of the entire earth's surface. The atmosphere in this movable torrid region is kept continually heated, — like a furnace, compared with the frigid zones, — and yet not equally heated at all hours of the day and night. The sun's rays are essentially vertical and torrid over a circle of the earth's surface three thousand miles in diameter for three hours. As this heated circle moves on from east to west, it creates an *easterly* wind when its centre is at the equator. As it moves more and more northerly, from the vernal equinox to the summer solstice, the easterly wind becomes more and more southerly; and then from the solstice to the autumnal equinox the wind becomes less and less south-easterly, till the sun reaches the equator.

The remaining six months the sun is south of the equator, and the wind changes by degrees to the north-easterly more and more, and then less and less, till the vernal equinox. These winds are the so-called "trade-winds" of commerce.

Now, it will be noticed, that while the sun is north of the equator, from the equinox in March to the equinox in September, the atmosphere is being pressed obliquely from the southern hemisphere into the northern; and these winds, being so constant for six months, must have a sensible effect, especially toward the close of this time, including a month or two following, as shown by my observations. And, as the opposite effect is produced when the sun is south of the equator, and the winds are pressing north-easterly, the greater weight of the atmosphere returns into the southern hemisphere, and we have a low average barometer in March and April; while our Southern friends must have a high average barometer in March and April, and a low one in September and October. Such must be one effect of the "trade-winds," if this theory be established. And here appears the importance of wider observations, extending into the southern as well as northern hemisphere, as a late article in the *Science News* wisely recommends.

Another cause tending to increase this effect of the more distant trade-winds, seems worthy of mention. From June to September, inclusive, the average direction of the winds in this locality for seventeen years has been more or less strongly southerly, while the rest of the year it has been northerly. These two causes, our local, and the more distant trade-winds, seem abundantly sufficient to account for the results indicated by these observations.

D. W.

QUESTIONS AND ANSWERS.

T. S., *Syracuse.* — What is electricity?

Answer. — No one knows the exact nature of electricity. Its *effects* and the laws governing its action are well understood; but *what* it is, is still a mystery. Probably it is a mode of motion, like light and heat. The causes which produce the electricity of thunderstorms and auroras are still a matter of doubt.

W. S. N., *Philadelphia.* — It is not uncommon for seeds to germinate in the interior of lemons or other fruit if the conditions of heat and moisture are favorable.

B. M. G., *Illinois.* — Would a wooden conduit half a mile in length be a suitable conductor for the water-supply of a city, from a sanitary point of view?

Answer. — We see no objection to the use of wood for this purpose. The aqueducts first built in this country were made of wooden logs bored lengthwise, and did good service till replaced by iron pipes.

J. G. H., *Minnesota.* — What is the chemical composition of Paris green, and also its antidote?

Answer. — Paris green is an arsenite of copper (Scheele's green). The proper antidote is freshly prepared ferric hydrate, which can be made by precipitating it from a solution of sesquichloride of iron, with excess of aqua ammonia, and washing the resulting mass with boiling water until the excess of ammonia is removed. The common medicinal dialyzed iron may also be used, and has the advantage of being always ready. Of course, the main dependence in cases of poisoning must be upon the prompt emptying of the stomach by emetics or the stomach-pump.

R. C. S., *New Orleans.* — What is diastase?

Answer. — It is a peculiar substance found in germinating seeds, in which it appears to be formed from the gluten of vegetable albuminous matter. It seems to act like a ferment, converting starch into dextrine and glucose. The "malting" of barley is due to this substance. It has never been obtained in a state of purity, and its composition is uncertain.

LITERARY NOTES.

The Sanitary Drainage of Buildings. By William Paul Gerhard, C.E. D. Van Nostrand, New York. Price 50 cents.

This valuable little book gives a brief description of the general principles on which the drainage and plumbing of a building should be constructed, as well as approximate estimates of the cost of the various fixtures and materials, and complete specifications for contracts for such work. All persons about to build or introduce systems of plumbing and drainage will profit greatly from a perusal of it.

A Compend of Pharmacy. By F. E. Stewart, M.D. P. Blakiston, Son, & Co., Philadelphia. Price $1.00.

This "Quiz-Compend" is not a text-book, but is intended as an aid to the student of pharmacy in connection with lectures and text-book, and in preparing for examinations. It is, in fact a complete compendium of pharmaceutical science in its most condensed form, and will be of the utmost service as a reference-book both to students and those who have completed their studies.

Messrs. D. C. Heath & Co. of this city have issued the fifth number in their series of educational monographs, entitled *The Study of Rhetoric in the College Course*, by John F. Genung, Ph.D. Price 25 cents. Teachers of rhetoric and composition will find in it many interesting and valuable hints in regard to the subject.

The Maverick National Bank of Boston has published, for distribution among its patrons, a very interesting and valuable volume of financial and industrial statistics, which have been carefully compiled by specialists from the very latest sources.

With the number for July 1, *Science* begins its tenth semi-annual volume, and celebrates the event by appearing in an altered form and a new dress. It will hereafter be published in the folio form, and the price has also been reduced from $5.00 to $3.50 a year, or ten cents per copy, or $4.00 with the *Popular Science News*.

The *Boston Journal of Health* is a new monthly publication, the first number of which contains numerous interesting articles on matters of health and hygiene. There is room for a journal which shall treat these matters in a rational and sensible manner, and we trust the new paper will fill the place which is waiting for it. Published at Boston (Roxbury P.O.) at $1.00 per year, or $1.90 with the *Popular Science News*.

Professor Shaler's article on "The Instability of the Atmosphere," in *Scribner's Magazine* for August, will contain reproductions of a number of photographs taken immediately after disastrous tornadoes in the West, which show the grades of destruction from centre to circumference of tornadoes, and the explosive effect of air contained in hollow walls.

Pamphlets, etc., received: The *Electric Light Primer* (50 cents), C. L. Levy, 61 Broadway, New York; *Electricity and Life*, by Edward C. Towne, B.A., Cambridge, Mass.; *Speech of Señor Don Matias Romero* upon the anniversary of the birth of Gen. Grant; *Report of the Columbus (O.) Agricultural Experiment-Station; Catalogue of the Albany (N.Y.) Medical College;* and the *Preliminary Circulars of the United States Geological Survey.*

Medicine and Pharmacy.

[Original in *Popular Science News.*]

CORPULENCE.

BY ROSS R. BUNTING, M.D.

Although there is a great cry throughout our country that people are getting too fat, as evinced by the numerous advertisements of anti-fat remedies (in which on one side is shown the portrait of a person of aldermanic proportions before taking the remedy, and on the other that of the same person with a wasp-like waist and of the most attractive appearance, after taking the remedy), yet the general desire appears to be to become fat, stout, fleshy. How the fond mother smiles when her friend, seeing her darling baby for the first time, says to her, "How fat it is!" Your friend, when he meets you on the street, knows he flatters when he says, "How well you are looking! How stout you are!"

Silenus, the attendant, the foster-father of Bacchus, is represented as a fat, jolly old man, crowned with flowers, and always intoxicated.

Julius Cæsar, in the play of that name, says: —

"*Cæs.* Let me have men about me that are *fat;* sleek-headed men, and such as sleep o' nights. Yond' Cassius has a lean and hungry look; he thinks too much: such men are dangerous.

"*Ant.* Fear him not, Cæsar; he's not dangerous. He is a noble Roman, and well given.

"*Cæs.* Would he were fatter! — but I fear him not: yet if my name were liable to fear, I do not know the man I should avoid so soon as that spare Cassius."

Lord Byron was an exception to this general desire to become fat. It is generally considered that he injured his health from his great fear of corpulency. Dr. Polidori, his physician, says he would refrain from food for days, and then appease his hunger with a wafer and a glass of brandy.

Fat is of great use in the human body in moderate amount, in which case it is generally considered a sign of good health. It forms one-twentieth of the weight of a man, and one-sixteenth of that of a woman. According to Dr. Hutchinson, a man five feet seven inches in height weighs 148 pounds; six feet in height, 178 pounds. Fat serves to protect the body from external violence, by uniform diffusion of pressure through the entire adipose tissue; it promotes the easy movement of different organs, as the heart and the eye-ball; even in cases of very great emaciation it always remains around these organs, motion being very essential to the proper performance of their functions. Fat also keeps up the heat of the body, on account of its imperfect conducting power. We have a marked instance of this in the whale and seal, animals exposed to very low temperatures. It serves as a store of material to make up for the loss of tissue, as from sickness (persons become very thin after illness); also in the case of hibernating animals, as the bear, hedge-hog, and others. It is said the loss of weight in these animals is nearly forty per cent, which equals the amount lost in death by starvation. The first few days after birth, the human infant loses in weight considerably, and, were there not a store-house of fat provided, would certainly die. "Fat and stupidity," says Lord Chesterfield, "are looked upon as such inseparable companions, that they are used as synonymous terms." Edmund Burke, speaking of the French Revolution, says that "fat, stupidity, irreligion, and avarice arise from one common cause." And yet David Hume, the historian, Edward Gibbon, author of the *Decline and Fall of the Roman Empire*, and Napoleon the First, grew fat: the first two whilst performing great intellectual labors; the last, although under the influ-

ence, during most of his life, of one of the passions one would think the least inclined to obesity, — ambition. Cullen considers obesity a disease when it renders persons, from a difficult respiration, uneasy in themselves, and, from inability of exercise, unfit for discharging the duties of life to others. The symptoms of corpulence are easily recognized, the more prominent being difficulty of breathing, inability to walk any great distance, difficulty in ascending a stairway, often tendency to palpitations, tendency to vertigo, dyspeptic troubles. In fat persons the bony framework is not so large as in those who are thin: they have generally small hands and feet. The bony skeleton has therefore very little to do with the weight in these cases; it is due to the adipose tissue. No doubt some noted characters of history, although somewhat corpulent, owed their large size to a great muscular development, as well as a large bony framework. We may cite, as instances, Marius the Roman consul, William the Conqueror, and John Sobieski. It is hard to believe that these active, energetic men were noted specimens of obesity. There have been some very remarkable instances of corpulence.

Daniel Lambert heads the list of fat people; he weighed 739 pounds. He died suddenly, in his fortieth year. He lived on the ground floor, as he was unable to ascend a stairway. The window and part of the wall of the room in which he died had to be taken away to make room for his coffin. Bright, another instance, weighed 616 pounds; died at the age of thirty years. "He came of a family noted for the great size and great appetites of its members." He enjoyed good health, married at the age of twenty-two, and had five children. His coffin was three feet six inches broad at the shoulders, and more than three feet deep; it was drawn to the church on a low-wheeled carriage by twelve men, and was let down into the grave by an engine fixed upon the church for that purpose. Seven men could be enclosed in the waistcoat he wore, without straining it. Boerhaave mentions the case of a man whose stomach was so large, that he was obliged to have it supported by a sash; he had a piece of the table cut out, to enable him to reach it with his hands.

Corpulence may commence at any time of life, although more common after the fortieth year, and more frequent in women than in men. It sometimes commences right after birth; so that, at two years of age, these children are as large as children of seven or eight years. These are generally monstrosities, and die early. In an examination of fifty-seven corpulent persons after death, by Dr. Chambers, fifty were found with diseased hearts of various forms. In sixteen there was an increased amount of vesicular fat about the heart. Wadd says: "A sudden palpitation in the heart of a fat person has proved as fatal as a bullet through the thorax."

In examining into the causes of the subject under consideration, we find that in many cases it is hereditary; in more than one-half of the corpulent persons we see, some of their immediate ancestors will be found to have had the corpulent tendency.

Climate as well as race would seem to have a great deal to do with its development. Erasmus says, that, in his day, for one stout person to be seen on the Continent, there were four in England. The Germans and the Dutch have also a strong tendency to corpulency. Finlayson says that in China the whole race displays a remarkable tendency to obesity.

The season has an effect: most persons are fatter in winter than in summer. Certain occupations have a decided influence upon the weight; that of coachmen particularly, where there is a moderate amount of exercise in the open air, and generally luxurious diet. Persons employed in breweries, where generally a large quantity of malt liquor is allowed them, very rarely are seen in a spare condition; the malt liquor, containing farinaceous and saccharine elements, as well as alcohol, forming a compound which is decidedly fattening.

Diet plays an important part in the production of obesity. Wadd says, "Among the Asiatics there is a sect of Bramins who pride themselves on their external corpulency. Their diet consists of farinaceous vegetables, milk, sugar, and sweetmeats. They look upon corpulency as a proof of opulence, and many arrive at a great degree of obesity without tasting any thing that has ever lived." It has been said that "in the Bey's seraglio at Tripoli women are fattened against a certain day by means of repose and baths, assisted by a diet of Turkish flour mixed with honey; fifteen days, it is said, are sufficient for the purpose." An oily diet is craved, to a certain extent, by all nations: the Esquimaux devours the whale oil; the inhabitant of warm climates uses his olive oil frequently, in place of butter. There is no doubt that "fat makes fat," — this saying, like many another of a popular origin, having a germ of truth in it, — and that a diet composed to a large extent of oily matter will induce a corpulent condition of body. Water alone is also one of the causes; fat people generally drink a great deal of water. We have referred to the quality of food, but the quantity has a very important bearing upon the causes of the condition of which we have been speaking. Cornaro said, that, "of all parts of a feast, that which one leaves does the most good." "Abstinence is an easy virtue, temperance a difficult one."

It was the custom with some of the emperors of Constantinople, at their coronation, while they were seated on the throne receiving the homage of the people, for masons to come with patterns of choice marble, and beg to know which the august person would please to have his tomb made of. The Egyptians carried a skeleton at their feasts, lest their guests, in the midst of feasting and merriment, should forget the frail tenure of life and its enjoyments. It has been said that all the flesh we ever gain is accomplished during sleep. The infant (usually fat) sleeps a great deal; fat people generally sleep a great deal. Old people sleep but little, and generally lose that rotundity of body which they possessed during middle life, and, as commonly expressed, "dry up." Wadd relates that "the physicians who attended Dionysius the son of Claudius, who lived in continual fear of suffocation from fat, adopted a very curious mode of keeping him awake: they appointed a person to prick his sides with very long and sharp needles whenever he fell into a profound sleep, which was not interrupted by the operation till the needle, having passed through the fat, arrived at the sensitive parts beneath."

Another cause of corpulence is want of exercise. Dr. Arbuthnot says that "spare diet and labor will keep constitutions, where this disposition is strongest, from being fat. You may see an army of forty thousand foot-soldiers without a fat man; and I dare affirm, that, by plenty of rest, twenty of the forty shall grow fat." Daucel relates that a very fat monk, asking his superior of the convent how he should become thin, was shut up in a room, being allowed plenty of water, but for solid food only bread, which he obtained from a large loaf suspended from the ceiling, and which he could only obtain by jumping in the air, and striking with an old sabre-blade, and then only get a few crumbs at a time. At the end of twenty days of this enforced partial abstinence and exercise he had become quite thin. Too little to do and a contented disposition would seem to unite two important conditions favorable to corpulency. An acute attack of illness is one of the exciting causes of obesity. After typhoid-fever, persons often become quite fat. Surgical injuries, as fractures of the lower limbs, have frequently the same effect.

The treatment of corpulency may, to a certain extent, be inferred from the remarks we have made when speaking of the causes. As we have already mentioned, the form of obesity commencing at birth, and increasing during infancy and childhood, is not amenable to treatment, as it is generally fatal before the age of puberty. Where there exists fatty degeneration of the heart, which we frequently find in fat persons, a physician should always be consulted, as the treatment must be modified to suit the particular case. Under forty years of age, *very much* can be accomplished by treatment, although there are some notable exceptions to this rule, as in the case of Mr. Banting, which we will consider farther on. The following are the rules of treatment of obesity without medicine: The quantity of food must be diminished; we must eat less. A medical friend much inclined to corpulence, informed me, that, in his own case, if he reduced the quantity of food, he soon noticed that he became thinner; when he found he could run to catch a car without getting out of breath, he considered himself all right. Our fat friends must follow the advice given by Abernethy to one of his noble patients: "Your lordship must do as the famous Duke of Wellington did on a well-known occasion, — cut off the supplies, and the enemy will leave the citadel;" they must take the sort of food that will produce the least amount of fat, but will give strength; they should therefore take more of nitrogenous and less of carbonaceous food. Of the five different sorts of animal food, — beef, veal, mutton, lamb, and pork, — the first is the least, and pork the most, heat-producing. The latter, therefore, should not be eaten.

"Thus saith the Prophet to the Turk:
'Good Mussulman, abstain from pork.'"

White bread makes heat and fat; rye is less heating; corn-bread fattens; oat-meal is good for strength, not for heat, is very suitable; rice makes fat; potato contains a great deal of starch, — not to be eaten; fruits may be eaten; milk is too fattening, contains butter and sugar of milk; coffee and tea can be taken, but not with milk or sugar. Water must be taken very sparingly, — one glassful in the twenty-four hours, if possible. Exercise must not be violent, as that produces an appetite; yet if it be walking, if perspiration is produced to a slight degree, it is an advantage. Eight hours' sleep is enough, as a rule, and seven will generally be sufficient. Some of this advice is very old, for the *Father of Medicine* says: "The obese person should eat but one meal a day, should not bathe, should sleep on a hard bed, and should walk as much as possible." Vinegar has been and is still used as a remedy for obesity, but, taken in sufficient quantity to produce any effect, it is injurious. There are persons who from a corpulent condition become quite thin (which is generally produced by disease), when the skin is in wrinkles; there appears to be too much skin; they present a very singular appearance. Those who lose flesh by a systematic treatment do not present this appearance. It is well for a person undergoing treatment to be weighed every two weeks. One pound a week to lose is in most cases sufficient. A lady under my care, after an attack of rheumatism, became very stout, — weight, 230 pounds; height, five feet six inches. The least exercise produced excessive dyspnœa. At the end of six months, after following the treatment above indicated, her weight was reduced to 190 pounds. She was able to walk without getting out of breath, besides being very comfortable in other ways.

The Banting system, named after Mr. Banting,

an undertaker of London, is very much the same as the treatment we have mentioned. This treatment, ordered him by his physician, Harvey, is but a modification of that of Daucel, a French army surgeon, who originated it about forty years since. He was sixty-six years of age, five feet five inches in height; weight, 202 pounds. He says, "I could not stoop to tie my shoe, nor attend to the little offices humanity requires, without considerable pain and difficulty. I have been compelled to go down stairs slowly backwards, to save the jar of increased weight upon the ankle and knee joints, and been obliged to puff and blow with every slight exertion." Under treatment he lost, in little over a year, 46 pounds, and says he "is quite well, and can walk up and down stairs like other men, and can stoop with ease and freedom."

As there are more thin people in the world than fat people, a word of advice to the former might not be out of place. They must sleep all they can; keep early hours for retiring; lie down in the middle of the day; drink a great deal of water; eat heartily, especially of farinaceous food; take plenty of exercise, but in moderation. Be cheerful. Sterne says that "every time a man laughs, he adds something to his life." And, according to Solomon, "A merry heart doeth good like a medicine: but a broken spirit drieth the bones."

Follow the old adage, "Laugh and grow fat."

[Original in *Popular Science News.*]

NECESSITY OF EXERCISE FOR SCHOOL-CHILDREN.

This is a subject of great importance, on account of the number of children interested, and the magnitude of the interests involved, and therefore should receive due consideration from the parents; because it is their duty, not only to the children, but to the community, to see that their children enjoy physical health, and possess strong bodies.

The school-children of to-day are to be the citizens and law-makers twenty years hence; it is, therefore, our duty to properly educate their bodies as well as their minds. A good physique is of more value to the youth than the accompanying mental endowments, since these may be indefinitely developed, while the former, if neglected in early life, may never be obtained.

There are many who secure a fine education, graduating with high honors, whose after-life is one of pain and anguish, and they die a premature death simply because they neglected the education of their bodies; while those who maintain strong bodies as well as sound minds will not only be better prepared for study, but for after-life.

Providence places in our hands the means of preserving health, and this gift involves a grave responsibility. It has been justly said, "Health will be counted among those talents for the use of which we are to answer to our Creator;" and it therefore becomes our duty to acquaint ourselves with those laws which regulate and govern it.

Girls are more apt to neglect exercise than boys, and hence they should receive greater attention from parents and teachers. They are to bring up children of their own; and it becomes their duty to maintain strong bodies, and to be versed in physical education, in order to train their children aright.

The teacher must not think that one-half the time is to be spent in recesses, or that the children should spend more time in play than in study; but recesses are necessary, and it is the duty of every teacher to see that the pupils not only leave the schoolroom, but that they engage in some agreeable amusement calculated to cheer and keep up the healthy action of the system, as well as strengthen the muscles.

Teachers and parents are very apt to forget that exercise is necessary to health, and they are often deceived in believing that medicine can cure the headaches and other pains of the children, caused by the constant breathing of impure air in improperly ventilated apartments; while the real cure is found in light exercise taken in the open air. Outdoor exercise is more profitable than indoor, and should be taken daily by all who would enjoy good health. Gymnastic exercise in our schools and homes *alone*, will not be sufficient, but, when accompanied by an occasional outdoor walk or sport, will be productive of great good. The use of light dumb-bells and Indian clubs are highly recommended to students.

It is of the utmost importance at all times that our lungs should receive a full supply of pure air, but this becomes an absolute necessity when exercising vigorously. If the air inhaled be impure, the exercise will not only prove of no benefit, but positive injury may result; hence gymnasiums and other rooms for exercise should be well ventilated, and should be kept as near as possible at a temperature of about 60° F.

Brisk exercise should not be taken just before or after a full meal. Cold water should not be drank immediately after exercising; the longing for water in this case is not due to actual thirst, but caused by the parched condition of the throat and tongue. Care should also be taken not to sit or stand in a draught of air at any time, and more especially after exercise, when the body is heated, and the pores of the skin open.

The child should not be allowed to exercise too vigorously at first; fifteen minutes of brisk exercise is sufficient for the beginner, and the time may be increased a few minutes each day.

The great benefit to be obtained by exercising a short time each day cannot be over-estimated. A miniature gymnasium may be arranged in every home at a slight expense, and a good physique may be obtained.

The time is coming when physical training will be counted quite as important, if not more so, than arithmetic or grammar; and then our "physical sins" will be shown up, and in due time corrected.

J. H. E.

ETRUSCAN DENTISTRY.

From a lecture reported in the *Independent Practitioner*, we take the following interesting account of some specimens of ancient mechanical dentistry:—

"It has been supposed that dentistry was a modern art or science. It is not at all modern, so far as the mechanical portion of it goes. The ancient Etrurians, who have given their name to Etruscan gold, are represented to us as being a very wonderful people. All of our records of them are obtained from their graves, and are necessarily few because of their custom of cremating their dead. But persons of distinction were sometimes buried in elaborate tombs. Some of these graves have been recently discovered, and Dr. Van Marter of Rome was enabled to secure the contents of one. Happily for us, the opening of these graves has revealed to us the exact condition of the mechanic arts of that day. We have not been able to decipher their language, specimens of which are found; but I am going to show you some specimens of their dentistry. I hold in my hand two pieces of dental art that are two thousand five hundred years old, — that date back to about the time of the supposed founding of Rome, seven hundred years before the Christian era, and which are among the earliest relics discovered. Here are three lower teeth — a bicuspid, a cuspid, and a central incisor — which are held together by a band of pure gold, not soldered, but beaten out of a solid piece of gold; the bands enclosing these three teeth all being connected by a bar of the same metal. The whole piece seems to have been made for the purpose of holding in position one of these teeth that had been implanted, or loosened by disease. There is also an upper incisor with an artificial crown. Here are also some decayed teeth from the same grave, that will show you that caries was as rife two thousand five hundred years ago as it is to-day. There are also some gold spiral ornaments for the hair, of exquisite workmanship. These teeth are excessively frail, and probably would fall in pieces if they were dropped upon the floor."

MONTHLY SUMMARY OF MEDICAL PROGRESS.

COMPILED EXPRESSLY FOR THE SCIENCE NEWS BY W. S. WELLS, M.D.

Mr. C. B. Keetley, surgeon to the West London Hospital, reports an operation which he calls "transplantation by exchange." The operation was performed on a child with a very large mole on the face, and consisted of the reflection of a flap from the child's arm upon the face, and the implantation of the mole on the arm, to prevent excessive cicatricial contraction interfering with motion.

The flap from the face was left attached by its inferior, that on the arm by its superior, border. The two were then rotated into position, and secured there by sutures; the arm having been brought close to the face for that purpose. A plaster-of-Paris bandage was then applied, so as to keep the arm close to the face and at rest. Both flaps lived, having been severed from their bases on the twelfth day. Nine months after the operation the result was announced as being quite satisfactory.

Dr. J. M. Barton, one of the surgeons at the Jefferson College Hospital, Philadelphia, recently performed a rare operation for chronic obstruction of the bowels, which had existed for about a year.

The patient being anæsthetized, Dr. Barton opened the abdomen, and found that the calibre of the large and small intestine at their junction had become contracted to the size of a quill.

The intestine was opened beyond the obstruction, and, by means of instruments and the finger, the contracted portion was dilated to its natural size. The wounds were then closed and dressed; and the patient at last accounts was convalescent, and practically out of danger. This is believed to be the first operation of its kind performed in this country, although similar ones have been performed by Professor Loretta of Bologna.

Amputation of the breast under local cocaine anæsthesia was lately performed at the New York Skiu and Cancer Hospital.

A rubber-covered ring was placed over the breast, and secured so as to retain the injected solution within the area of operation. The line of incision was traced by tincture of iodine, and injections of a two per cent solution of cocaine *into* the layers of the skin were made at intervals of about one-half inch entirely around the tumor. The patient felt only the first insertion of the needle. Several larger injections were also made beneath the tumor. Less than three drachms were required. There was no pain during the operation until after the ring had been removed, and the last of the sutures were being applied, when she felt the needle in a small section of the lower flap only. There were no after-symptoms due to the anæsthetic. Twenty-five minutes were consumed in the operation.

The wound was closed with the continuous horse-hair suture, and the same material was used for drainage. Healing was complete in ten days.

This patient was a feeble old woman of seventy-eight years, with double cardiac murmur. There was no adhesion of the mammary tumor to the chest-wall, nor were the glands in the axilla involved.

IN a recent communication to the Société Médico-Practique of Paris, Dr. Peyrot related, among others, the case of a young man who had received a wound of the middle finger, severing the flexor tendon at the junction of the first and second phalanges. The finger was in a state of forcible extension, and posterior luxation was threatened.

This condition had existed for six months, and it was impossible to approximate the ends of the severed tendon by suture. The operator removed from a young dog a piece of one of the flexor tendons of the paw, and, having freshened the ends of the divided tendon in the patient, united them by three sutures to each extremity of the transplanted tendon. The wound healed without suppuration; and, when the patient left the hospital, he was able to execute feeble movements of flexion of all the phalanges of the injured finger.

As diphtheria presents both local and constitutional symptoms, Dr J. H. Fruitnight of New York recommends the hyposulphite of soda as accomplishing both purposes, by retaining the solution in the mouth for a time before swallowing the dose. The doctor has treated eight cases of diphtheria with this remedy, giving hourly doses of one drachm of a solution of the strength of ʒi. of the hyposulphite of soda to ℥ ii. of water. In all the cases there was a gradual lessening and disappearance of the membrane from hour to hour. No other local remedies were employed, though the general condition of the patients received proper attention.

Where the disease has invaded the larynx, and in cases of infants, he recommends the use of the spray-atomizer to carry the solution over the parts, and for the nares and posterior pharynx, a syringe.

M. DUJARDIN-BEAUMETZ recommends that persons suffering from biliary calculus should be enjoined to abstain from all fatty substances and carbo-hydrates, which may furnish cholesterine. Peas, in particular, should be forbidden, as they contain a fatty substance similar to cholesterine; and the use of meat and eggs must be avoided as much as possible. All green vegetables, and also potatoes, may be allowed, and fruits which are not sweet may be taken. Pastry should be forbidden. Meals in small quantity should be taken frequently, in order to keep the gall-bladder at work. Wine mixed with Vichy water makes a good drink. The bowels should be kept open, and plenty of exercise ordered.

IN the treatment of internal aneurism Professor Da Costa regards the iodide of potassium as a remedy deserving of confidence beyond all others. He gives Gr. xx. *ter. die*, increased to the point of tolerance. In addition, he keeps the action of the heart subdued by aconite, and for pain applies over the location an ointment of one grain of aconite to sufficient vaseline. Ice may also be occasionally applied over the ointment locally.

Quietude, rest in bed, and a dry diet are enjoined.

IN the treatment of "black eye" the *St. Louis Medical and Surgical Journal* avers there is nothing to compare with the tincture, or a strong infusion, of capsicum an. mixed with an equal bulk of mucilage of gum-arabic, and the addition of a few drops of glycerine. This should be painted all over the bruised surface with a camel's-hair pencil, and allowed to dry on; a second or third coating being applied as soon as the first is dry. If done immediately after the injury is inflicted, the assurance is given that this treatment will prevent blackening of the bruised tissue.

DR. PETER HOOD recommends, in the *London Lancet*, a three months' course of carbonate of lime for the arrest of cancerous growths. Dr. Hood has tried this plan in various cases occurring in his practice during the past twenty years, and experience confirms its utility.

THE etherial solution of tannin, of sirupy consistence, is said to immediately soothe the pain of burns; it dries rapidly, and forms a pliable, non-elastic coating, which is preferable to collodion, as it does not shrink or stiffen.

IT is asserted in the *Medical World*, that, if you desire as speedy action of drugs swallowed, as if you gave them hypodermically, administer them in hot water. One-half the dose will suffice if given hot, as it is quickly absorbed from the stomach, and the force of the drug thrown upon the system at once.

MEDICAL MEMORANDA.

THE Philadelphia truss factories turn out over 200,000 trusses per year.

IN the healing of burns and scalds, where there is danger of contracting scars, rub the new skin several times a day with good sweet-oil. Persist in this rubbing until the skin is soft and flexible.

UNGUENTUM BELLADONNA IN RHUS-POISONING. — The official ointment of belladonna is recommended in the treatment of rhus-poisoning by John H. Bailey of Kentucky. He states he has employed this remedy for many years, and has never known it to fail. The eruption, as a rule, disappears in from "two to five days."

GREAT MEN AND THEIR DISEASES. — Gibbon, the historian, had one of the largest hydroceles on record; Benjamin Brodie had a malignant disease of the shoulder-joint; Pirogoff a sarcomatous epulis of jaw; John Hunter a rupture of the tendo-Achilles; Napoleon a cancer of the stomach; Sir Astley Cooper a fractured fibula; Cæsar and Byron were epileptics; Hodgen died from a perforation of the gall-bladder, the article on which in Holmes's *Surgery* he had shortly before revised.

CONTAGION IN LAUNDRIES. — Dr. Russell, medical officer of Glasgow, says, that, during the last ten years over a million of articles (from persons affected with every kind of contagion known in this country) have passed through the Glasgow laundry, and that he has never known a case of interchanged disease, although the women engaged in the laundry have occasionally suffered from handling the linen before the boiling process.

APOTHECARIES AND CONFECTIONERS. — In the thirteenth and fourteenth centuries there were certain officers, called apothecaries, retained by princes and great personages, who prepared various preserves for the table, — more especially fruits incrusted with sugar. Beckman has recorded many curious notices illustrative of the connection between the apothecary and the confectioner as they were publicly established in Germany from the middle of the fifteenth century. Their establishments were licensed by authority, and the persons who kept them endowed with exclusive rights and municipal privileges, in return for which they were sometimes required to supply the court or the municipal authorities, as well as to vend their medicines and confections at appointed rates.

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ONE DOLLAR A YEAR, IN ADVANCE.

SETH C. BASSETT,
MANAGER.

Publishers' Column.

EVERY sentence should be strictly punctuated. Millions may depend on a comma. Esterbrook's Pens are admirable for the purpose.

THE results of ignorant attempts to supply a substitute for human milk are, no doubt, sufficiently disastrous; but a diet chosen with care and given with judgment will seldom disappoint our expectations. MELLIN'S FOOD has been prepared to meet this want, and is now thoroughly established as the *best* nutriment for infants and invalids ever known.

MARINE HOSPITAL, PORT OF BALTIMORE,
Jan. 16, 1875.

DEAR SIR, — In compliance with your request to give you my opinion of COLDEN'S LIQUID BEEF TONIC, I take pleasure in recommending it as a most excellent stimulant, tonic, and invigorator of the system, which can be used whenever a stimulant and tonic combined is not contra-indicated. I have tested it in many cases since its introduction into our market, with universal success.

Very respectfully yours, etc.,
WM. F. STEUART, M.D.

DR. W. S. LEONARD, Hinsdale, N.H., says: "I have used HORSFORD'S ACID PHOSPHATE in my practice for the past eight or ten years, and have been much gratified with the results obtained from its use. In various forms of dyspepsia it reaches a class of cases that no other medicine seems to touch, and I have repeatedly seen patients, where opiates were contra-indicated, obtain refreshing sleep and rest at night from a single dose at bed-time."

ABERDEEN, MISS., Dec. 1, 1885.

MR. DAVID BOYLE, CHICAGO, ILL.

Dear Sir, — At the end of my first year's experience in operating one of your patent ice machines, it gives me pleasure to report that no trouble was met with. The machine regularly produced more than its rated quantity of first quality of ice, and, having been cared for by men entirely without experience, proves to me the simplicity and reliability of your machinery. I am entirely satisfied with your machine.

Yours truly,
SAMUEL KAYE, *Proprietor*.

MR. JOHN MICHELS, 200 East 27th Street, New York, N.Y., will send, on receipt of $1.05, a vial of ready-cleaned diatoms from the famous Mobile Bay deposit, prepared by Dr. Taylor of Mobile. Each vial contains sufficient material for a hundred slides, and comprises nearly a hundred different varieties.

SAWYER'S HOT-WATER HEATING APPARATUS, advertised in this issue on the sixth advertising page, is the invention of a practical machinist, and is constructed upon a new plan, by which an unusually large proportion of the calorific power of the fuel is utilized. Persons intending to place heating apparatus in their buildings the present season will do well to correspond with the inventor and manufacturer.

ESTERBROOK'S STEEL PENS

Leading Numbers: 14, 048, 130, 333, 161.
For Sale by all Stationers.
THE ESTERBROOK STEEL PEN CO.,
Works, Camden, N. J. 26 John St., New York.

The Popular Science News

AND

BOSTON JOURNAL OF CHEMISTRY.

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CONTENTS.

FAMILIAR SCIENCE. — Take care of the Hair 125
Chemistry of the Writing-Desk 125
Self-Mutilation of Animals 126
The Death of Lavoisier 127
The Long-leaf Pine 127
The Tongue of the Humming-Bird 128
Scientific Brevities 128
PRACTICAL CHEMISTRY AND THE ARTS. — A Simple Oil-Stove 129
A New Process for Coloring Copper and Nickel 129
On Metallic Manganese 129
Electricity on Tramways 129
Danger from Gas-Meters 130
Effect of Impurities in Gold Alloys 130
The Adjustment of Delicate Balances 130
Industrial Memoranda 130
HOME, FARM, AND GARDEN. — The Mysteries of Plant-Growth 131
The Early Inhabitants of America 132
Household Hints 132
EDITORIAL. — Baffled Investigators 133
Prehistoric Flint-Mines 134
In a Laboratory 134
Louis Pasteur 135
Astronomical Phenomena for September, 1887 135
Meteorology for July, 1887 136
Questions and Answers 136
Literary Notes 136
MEDICINE AND PHARMACY. — A Word upon Tea and Coffee, 137
Monthly Summary of Medical Progress 137
Metastatic Inflammation of the Brain cured by Simple Remedies 138
Influence of Altitude on Phthisis 139
The Skeleton Industry in France 139
The Temperature of the Skin 139
Leeches of Japan 139
Toilet Powders 140
Humors 140
PUBLISHERS' COLUMN 140

Familiar Science.

TAKE CARE OF THE HAIR.

BY THE SENIOR EDITOR.

No careful observer fails to notice, as he looks over assemblies of men past thirty years of age, that a very large proportion are bald, or in a stage of partial baldness, which indicates the speedy loss of the hirsute appendage. The percentage of men of all ages who show signs of baldness, has been put at thirty per cent, and by some observers as high even as forty per cent. From careful observations in churches, theatres, lecture-rooms, and political assemblies, we are satisfied that these estimates are too high, and that twenty-three or twenty-four per cent is a more exact estimate.

This exhibit is alarming, as it indicates that the time is near when we shall be a nation of bald-heads, and that alopecia as a disease will afflict the youth in our schools, as through heredity, physical deformities and illnesses are multiplied and extended to an enormous extent.

What is the cause of this early loss of hair? It is not due to the hats or caps we wear, not to the clipping of the hair close, not to living in hot rooms; it is not due to the forms of foods we consume; but, in our view, it is largely due to modern methods of treatment of the hair and scalp. The erroneous view prevails, that the skin which holds the hair-follicles and the delicate secretory organs of the scalp must be kept as "clean," so to speak, as the face or hands: consequently young men patronize barbers or hair-dressers, and once or twice a week they have what is called a "shampoo" operation performed; and this consists in a thorough scouring of the hair and scalp with dilute ammonia, water, and soap, so that a heavy "lather" is produced, and the glandular secretions, which are the natural protection of the hair, and promotive of its growth, are saponified and removed. No act could be more directly destructive of a healthy growth of hair than this, and no one is more common.

The practice of frequently washing the head in warm or cold water, at home, with or without the adjuncts of soap, alcohol, ammonia, or perfumery, is deleterious, and promotive of early loss of the hair. Men in active indoor business, clerks, bankers, shop-keepers in cities, are continually washing the head. Many do this night and morning, under the false notion that it is necessary to cleanliness, and promotive of a vigorous growth of hair; and, when alarmed at its rapid disappearance in early life, they are at loss to understand the reason. The secretion of wax in the ear-passages is nature's method of protecting the delicate machinery upon which hearing depends. It closes the organ to the entrance of insects and dust; and fortunately the secretion is, to a considerable extent, placed beyond easy interference, and thus the sense of hearing is protected from injurious "washouts."

The waxy secretion which is poured out from the glandular organs which are found in connection with the follicles of the hair, is nature's product, and is designed to preserve and protect the wonderful and beautiful head-covering. If we persist in removing it altogether, we must march with the bald-pates before the frosts of age come along to change its color. Women do not shampoo or wash the hair as often as the other sex, and consequently they are in a large degree exempt from baldness in middle life. It is true, however, that many women in cities make frequent visits to the hair-dressers, and subject their tresses to the "scouring" process. If this becomes common, it will not be long before baldness will overtake the young mothers as well as the fathers, and the time will be hastened when children even will have no hair to destroy with ammonia or other caustic cosmetics.

The advice we have to offer to young men and maidens is, — let your hair alone; keep at a safe distance from hair-dressing rooms and drug-shops, where are sold oils, alkaline substances, alcoholic mixtures, etc., for use upon the hair. They are all pernicious, and will do you harm. The head and hair may be washed occasionally with soft, tepid water, without soap of any kind. As a rule, the only appliances needed in the care of the hair are good combs and brushes; and they should not be used harshly, so as to wound the scalp. Avoid all "electric" and wire-made brushes. No electricity can be stored in a hair-brush: if it could be, it is not needed. The hair is a beautiful gift of nature, and it must not be destroyed.

CHEMISTRY OF THE WRITING-DESK.

COMMON ink, chemically considered, is a substance of much interest. The majority of inks at present used are made from ferrous sulphate (copperas) and infusion of nut-galls. These last contain a peculiar organic acid known as gallotannic acid or tannin ($C_{14}H_{10}O_9$): this readily unites with the iron of the copperas, forming *ferrous* gallotannate, which is nearly colorless, and quite soluble in water. On exposure to the air, however, this soon oxidizes to *ferric* gallotannate, which is an intensely black, insoluble substance. It is this oxidation which causes ink to turn black after exposure to the air, either in the inkstand or on the written page. The solution of the ferrous salt is always used for writing, as it is clear, and flows readily from the pen; and a little aniline, or other coloring-matter, is added to it, to render the writing visible before the true color of the ink is developed by the oxygen of the air.

Solutions of aniline blue or violet are often used for writing-purposes, for which their intense coloring-power renders them very suitable: their only disadvantage is, that they fade quickly; and letters written with such ink, if exposed to light and air, soon become illegible.

A fluid of an intense black color can be made by adding to an infusion of nut-galls a few grains of vanadate of ammonia dissolved in a little hot water. The coloring-matter is not a solid precipitate, but is held in solution, and makes a most excellent ink; but, unfortunately, it is not very permanent. Inks are usually thickened with gum arabic to give them sufficient "body;" while copying-ink only differs from ordinary writing-fluid by containing sugar or glycerine, which prevents it from drying too rapidly. When a sheet of paper written over with copying-ink is pressed firmly against a sheet of thin, absorbent paper, previously moistened, a part of the ink is transferred, thus producing a complete copy of the original writing. India ink is simply carbon, or lampblack mixed with gum, and moulded into sticks. It is very permanent, and does

not corrode steel pens, but must be prepared fresh every time it is used.

A perfect ink should be a thin, free-flowing liquid of a deep black color when first used, non-corrosive, entirely permanent, not easily removed by chemical agents, and leaving but little residue when evaporated. Of the innumerable inks in the market, none possess all these qualities; and we have yet to find an ink which is perfectly satisfactory.

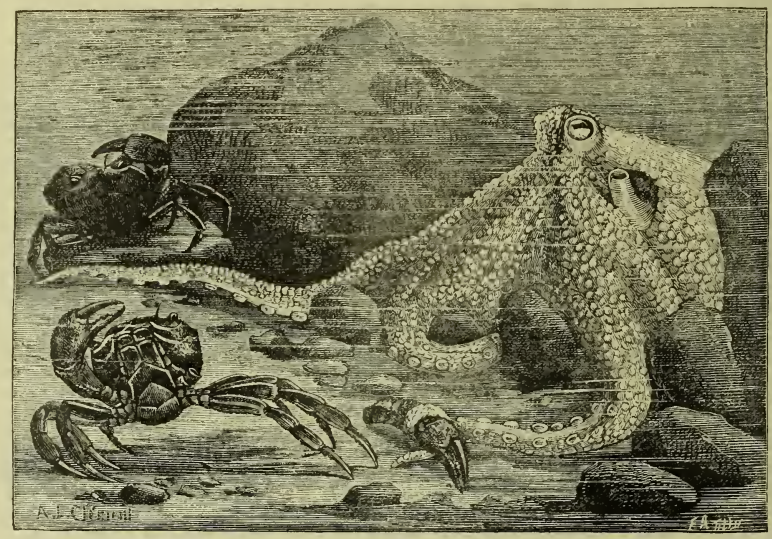
Writing-paper, chemically considered, is nearly pure cellulose ($C_6H_{10}O_5$). It has the same composition as starch, like thousands of other organic bodies which have similar chemical compositions, but widely differing physical properties. The only explanation that can be given of this strange fact is, that the atoms are differently arranged in the different substances, just as the same figures may be arranged to denote numbers of widely varying values.

Physically considered, paper is a thin sheet of vegetable fibres felted together, and is a striking proof of man's ingenuity. Writing-paper is heavily "sized" with a mixture of glue, starch, resin, etc., to give it a hard, smooth surface, suitable for receiving the ink. Blotting-paper is a thick, heavy paper, entirely unsized, so that it readily absorbs any ink or other fluid brought in contact with it. The ruling of paper is done by a very ingenious machine, so complicated, that an apprentice in the paper-ruling business requires several years in which to learn the trade.

Concerning pens, there is little to be said: they are made from the best varieties of steel, which, as our readers know, differs from iron in the amount of carbon, and possibly some other elements, combined with it. Our practical knowledge of the metallurgy of steel is very complete and satisfactory; but there is still much to be learned as to the theoretical part of the science, and the chemical significance and action of the various elements upon iron.

Lead-pencils in former times were really made of lead, and pencils with a marking-point of metallic silver are occasionally met with; but graphite is now almost exclusively used. This is nearly pure carbon, like charcoal, or the diamond, but contains a small amount of iron, which some chemists consider to be simply an impurity, and not in chemical combination.

Wafers are but little used at present, and are simply small pieces of colored gelatine or gum. They are often colored with the poisonous red-lead, and for this reason should not be moistened in the mouth. They have been superseded by the self-sealing envelope, on the flap of which is placed a little dextrine, or British gum, which only needs to be moistened to firmly seal up the envelope. This dextrine is made from starch by the action of heat and acid. It has the same chemical composition as both starch and the cellulose of the paper; that is, chemically speaking, it is isomeric with those substances. This same gum is used upon the backs of postage-stamps. It is said that the process of transforming starch into dextrine was discovered accidentally by the partial burning of a starch-manufactory in England, but we cannot vouch for the truth of the story.



Much more might be written regarding the scientific principles involved in the use of sealing-wax, stylographs, hektographs, papyrographs, and many other inventions designed to lighten the labors of the writer; but lack of space forbids a more extended account of them.

SELF-MUTILATION OF ANIMALS.

OUR readers will recall an interesting account by our Paris correspondent in the July number, of the researches of MM. De Varigny, Frédéricq, Parize, and others, upon the power possessed by crabs, and some other animals, of casting off a limb when roughly injured or irritated. An article in a recent number of *La Nature* discusses the matter at length, and is accompanied by a fine illustration, which we reproduce, showing how this act, for which the name "autotomy" is suggested, may be of use to an animal in allowing it to escape from its enemies. M. Parize tried the experiment of placing a common crab (*Cancer Mœnas*) near a large octopus, which is found upon the coasts of Brittany, and lives largely upon these crustacea. The octopus seized the crab by a claw with one of his tentacles; but, as soon as the crab felt the pressure, he quietly abandoned the unfortunate member, and hurried away to a safer locality, and, if crabs have any sense of humor, doubtless laughing at the disappointment of the octopus, who was defrauded of his dinner in such an unfair manner.

Fortunately, the crab suffers little inconvenience from his self-mutilation. In a short time a new limb is reproduced, fully equal to the old one, and ready to be abandoned in its turn if occasion requires. Lobsters and some other crustacea possess the same faculty, both of self-dismemberment and reproduction of lost limbs. Certain spiders, on the contrary, although they can cast off their legs if necessary, never recover them, but remain partially crippled for the remainder of their lives.

M. Parize considers that autotomy is largely a voluntary act, and that the animal deliberately sacrifices his limb to escape from his enemy, agreeing upon this point with Professor Huxley; but M. Frédéricq, on the contrary, thinks that it is a reflex phenomenon, caused by the irritation of the limb, just as we instinctively close our eyes when a grain of sand is blown into them, or start at a sudden noise. In proof of this, he relates that a half-dozen crabs were kept in a drawer, and a claw of each securely tied to a nail: by jarring the drawer, the captives were frightened, and made frantic efforts to escape; but the idea of casting off the claw did not occur to them. If, on the contrary, a claw which was not tied to a nail, was crushed or irritated, it was promptly dropped; thus showing that it was the irritation, and not the desire for liberty, which led to the loss of the limb. In addition, M. Frédéricq found that autotomy occurred with crustaceans deprived of their heads, or with their "intellectual faculties" under the influence of chloroform.

This remarkable phenomenon was observed by Réaumur, who wrote a lengthy article upon the subject as early as 1712; but the investigations of the above-mentioned modern scientists have shed much additional light on the subject, and given us a rational explanation of a most curious, and, to many persons, a novel fact of natural history.

[Original in *Popular Science News.*]

THE DEATH OF LAVOISIER.

A RECENT paper, published in the *Revue des Deux Mondes* by E. Grimaux, the able teacher in chemistry in the *École polytechnique*, has been devoted to the history of the death of Lavoisier; and its contents prove a very valuable addition to an important point of scientific history, concerning which little was known. M. Grimaux has been able to discover very useful documents in the *Archives* of Paris, and in the family documents of Lavoisier; and his researches cast a new light on the tragical end of the great chemist

Lavoisier, it is well known, held an important financial office some time before the Revolution. He was one of the *fermiers-généraux*, who were in charge of collecting revenue-taxes. This corporation was a very unpopular one. The last *fermiers-généraux*, among which Lavoisier held office during twenty-two years, were, however, generally honest men; and the popular feeling against them was due much more to scandals of the past, than to any present one. In 1789 a pamphlet against the corporation contained but slight accusations; and the only grudge entertained towards Lavoisier, was that he had a box at all the theatres. However, the institution, being an unpopular one, was suppressed in 1791, and it was decided that it should be considered as having been suppressed since 1789. A committee was appointed to review all operations conducted since 1789, and settle the matter. From 1791, Lavoisier, and some twenty-seven other *ermiers généraux*, were dismissed. Although it discovered little that could be really criticised, the popular feeling was that some three or four hundred millions of francs had improperly got into the pockets of these functionaries; and in the convention, there was a political party in favor of having them prosecuted. The fact is, that, if the *fermiers-généraux* were possessed with twenty-two millions of francs, it was all ; but popular feeling exaggerated all things greatly. In 1793, before the committee had been able to report on the question, a member of the convention, Carra, proposed a decree by which a committee was appointed to investigate all errors, improprieties. or thefts concerning the finances of the state. This was not enacted, owing to other political incidents. A few months later, the papers of the former *fermiers* were confiscated, at the very moment when Lavoisier was in charge of the organization of the Weights and Measures Committee. Lavoisier's dwelling was visited by force, and all his papers searched. A bundle of English correspondence was seized upon, however, and has not been found since : it contained letters from English scientists, and would certainly prove very interesting for the history of chemistry. Some time after this, a member of the convention, Dupin, proposed that five persons be added to the committee, to investigate the accounts since 1774, and see whether any improper acts had passed in them. These five persons were former employees of the *fermiers*, dissatisfied and envious, and quite devoid of scruples. Fearing that these persons would be quite ready to invent offences where none could be found, the former *fermiers* decided to set to work also, and prepare a summary of these accounts independently. Lavoisier took no part in this work : he was at this time much concerned with investigations on the dilatation of metals in reference to the establishment of the standard meter, and other occupations. At that time Marat — who had tried scientific studies, and whose *Traité du feu* had been, as it deserved, quite scornfully treated by the Academy of Sciences, and by Lavoisier more particularly — began violent attacks upon the *fermiers*, and upon Lavoisier, towards whom he had much hatred. At the end of 1793, Bourdon proposed, that, if the accounts of the *fermiers* were not ready in a month, all of them should be placed under arrest, in defiance of the decree already passed, by which four months and a half had been allowed. The convention thought it was even better to have them immediately arrested. This was done. Lavoisier hoped that the work he was doing in the Committee of Weights and Measures would be a reason for a delay in arrestation, and wrote to the *Comité de Sureté générale*, but uselessly. With the others he was arrested and detained in a building, at present part of the *Maternité* hospital in Paris. The *fermiers* were allowed to mingle together, and had been told to take with them all the papers of use in the establishment of their accounts. During this time, the feeling against them was steadily growing in the convention, but they took not much heed of it. Some friends of Lavoisier interceded in his favor, but uselessly ; and his wife's steps towards his release were fruitless. His residence in Paris, and his castle of Treschines, were put under seal. The committee appointed by the convention was continuing its work; but the results of it were not made known to the *fermiers*, who were utterly-unable to prepare their defence. They were, however, confident of success. The five members who had been added to the original committee, after many efforts, could only say, that, in their opinion, the *fermiers* had in all prevaricated a sum of one hundred and thirty millions (instead of four hundred, as they had said before); and this was untrue, as has been recognized since, even by Dupin the principal enemy of the *fermiers*. The *fermiers* were also accused of having caused the snuff-tobacco to be too much *watered*, and of having by these means injured public health. The truth is, that the privilege of preparing snuff had been made a monopoly by the *fermiers*, thereby injuring the business of a great number of retailers who did it themselves, and lived on it. However, there were some faults in the preparation of snuff; and Lavoisier himself had called attention to it, saying, "I fear the addition of water has gone farther than it ought to; . . . one must be very reserved concerning this: and it is better to make smaller profits, and not incur the chance of dissatisfying the public."

The report of the committee was discussed in the conventiou : the persons who wished to defend the *fermiers* were not heard, and even prevented from speaking. The result of it was, that the *fermiers* were deferred to the *Tribunal Révolutionnaire* by decree of the 5th of May, 1794, and, in violation of all forms, immediately sent to the *Conciergerie* before the decree had even been registered. Till then the *fermiers* had thought that the whole business would have no results, that their innocence would be entirely clear; but when they felt themselves in Fouquier-Tinville's hands, all hope was immediately lost, the Revolutionary Tribunal being one that never dismissed its prey. The next day, 7th of May (18th of *floréal*), the *fermiers* were each briefly questioned. Lavoisier was asked whether he had not squandered public money, and rendered himself guilty of fraud towards the people. Lavoisier answered that all errors he had perceived, he had made known, as he could prove by substantial documents. This was all. Lavoisier's last letter is of this day, and one of its passages runs thus: "So it is true that the fact of having accomplished all social duties, that important services rendered to the country, a life usefully employed for the progress of arts and of human knowledge, are not enough to avert a tragic end, and prevent dying the death of a culprit." In the early morning of the 8th of May, the *Tribunal Révolutionnaire* remanded the *fermiers*. Coffinhal was the president. The interrogatory lasted an hour and a half for all, and was a complete farce: not a single fact was discussed, no proof was given of the slightest guilt of the *fermiers*, and the question which was submitted to the jury is a masterpiece of infamy. It runs as follows: —

"Has a plot existed against the French nation, tending to favor all enemies of France by all possible means, consisting in all sorts of frauds and prevarications towards the people, in adding to tobacco, water and matters that are obnoxious to the health of citizens?" etc. The jury returned the answer *yes*. The tribunal immediately sentenced the *fermiers* to death, by application of the article of the penal code, which provides that death shall be the punishment of all who are in intelligence with the enemy. The *fermiers* were sentenced as if they had been traitors proved guilty of having furnished weapons, money, or any other means of superiority, to an enemy. This would be laughable if it were not so sadly infamous. That afternoon the twenty-eight *fermiers* were beheaded, Lavoisier the fourth in turn. All died nobly, without complaining. As Lagrange said the next day to Delambre, speaking of Lavoisier, "One moment has been enough to cut that head off, and a century will perhaps not be enough to give the world one equal to it."

M. Grimaux, wishing to ascertain how it has happened that no serious and important steps were taken to protect Lavoisier, illustrious as he was, is very severe concerning Fourcroy, the chemist, who has been directly accused of having somewhat contributed to Lavoisier's death. Fourcroy was jealous of Lavoisier, and could have done something for him, but did nothing.

Of all the hideous crimes enacted by the Revolution, under the pretence of justice, none will seem more atrocious than that which culminated in Lavoisier's assassination, to those who value science and scientific progress. Such crimes are a permanent shame to the party who has enacted them.

H.

[Original in *Popular Science News.*]

THE LONG-LEAF PINE.

BY THOMAS C. HARRIS.

THAT the pine is one of the most useful of all the trees common to the South-Atlantic States, no one who has given the subject a thought will deny. In North Carolina, there are found eight varieties of pines, of which the long-leaf, or *Pinus Australis*, is the most useful, though confined to the eastern counties, and not to be seen west of the centre of the State. Its range is from the southern counties of Virginia, all the way to Florida, and occupies most of the dry, sandy soil of those States.

In addition to the useful purposes to which this tree has been applied for many years, other uses and new commercial products have been of comparatively recent application. A brief enumeration of these will probably prove interesting.

It makes the best lumber for general purposes, and is commonly used all over the Union. It is from this pine that the turpentine gum is obtained, by chipping away the bark in spring, and allowing the gum to exude and flow down into a "box" or cavity cut to receive it. As is well known to every one, this gum is distilled, and the product is spirits of turpentine ; the resin remaining in the still, from which it is drawn while hot into barrels. On cooling, it solidifies into a solid mass of brittle resin, or *colophony*.

There are some fourteen qualities of resin known to the trade, ranging from a coarse black resin, to the finest pale-amber colored, known as "window-

glass resin." The prices range from sixty-five cents to three dollars and a half per barrel, according to quality.

The rich resinous wood and "lightwood knots" are split, and burned in a kiln, and produce the common tar. In the old school-geographies, this "tar, pitch, and turpentine" is set forth as a leading industry in North Carolina. From the fact that this tree is confined to the eastern counties, which were the first ones settled by white people, this statement was made with some degree of truth, say a hundred years ago. Now it is but of small importance in the State. In South Carolina and Georgia it is a large industry.

From the sap, leaves, and wood are made several forms of proprietary medicines, more or less useful in pulmonary complaints, and for external use in the form of liniments.

Within the last few years, the leaves, or needles, have been first utilized, and put into salable forms. Previous to that time, they were occasionally used as a litter for barn-yards, etc., for which they were not well adapted on account of their non-absorbent character. Now the article known as pine hair, or pine fibre, is a new and growing industry.

The needles are gathered in a green state, and steamed in a sheet-iron vessel, through which the steam passes to a receiver, and is condensed into an oil having an agreeable balsamic odor, and excellent antiseptic qualities. This oil forms the base of some of the best known liniments, and is highly esteemed as a domestic remedy for cuts, burns, bruises, and the like. After the steaming process, the needles are crimped by special machines into a close zigzag form, for making mattresses; or are carded into a fibre for general upholstery purposes, to which it is finely adapted. In this form it closely resembles oakum, but is much more elastic.

Aside from its elasticity and cheapness for bedding, it has undoubted medicinal properties by inhalation of the pleasant balsamic odor, and the property of driving away insects, — especially the *cimex lecticularis*. The finer fibre is made into rolls of wadding for hospital use, taking the place of lint in surgical cases with decided advantage. The same fibre is also spun into yarn, and woven into a variety of carpets and matting for floors, and is cheap and popular.

The wood is subjected to a form of distillation by a new process, and produces wood-spirit, creosote, "soluble pinoleum," tar, and charcoal. From the smoke is produced lampblack. The creosote is used mainly for saturating piles, posts, bridge-timbers, and cross-ties, to prevent decay. When used on piles, it prevents the ravages of the *teredo*, which destroys so many wharves in Southern waters.

The cones, chips, and bark are sometimes saturated with low-grade resin, and sold in barrels for kindling fires. The root has medicinal qualities also, and is sometimes so utilized. In the early spring the bark of the root has a sweet taste, and forms an important part of the food of the native "razor-back hogs," running at large in the forest.

In the dry, upland section, where this pine is the prevailing growth, it imparts some of its healing property to the atmosphere, supposed to be due to a high per cent of ozone, making it specially beneficial to persons suffering from bronchial or pulmonary complaints. Thousands of well-known cases of persons contracting these diseases in colder climates, have been much benefited by a winter spent in these pine forests.

Thus we find, as the product of one kind of pine, — lumber, shingles, crude turpentine, spirits of turpentine, resin, tar, pitch, lampblack, charcoal, oil from needles, crimped (mattress) needles, carded fibre or pine hair, wadding, carpets, bagging, wood-spirit or alcohol, creosote, pinoleum, kindling, and numerous medical preparations. A very useful tree indeed.

DEPARTMENT OF AGRICULTURE,
RALEIGH, N.C.

THE TONGUE OF THE HUMMING-BIRD.

THERE still seem to be two opinions in vogue relative to the structure of the tongue in the humming-birds. In his second edition to the "Key to North-American Birds," Professor Elliott Coues tells us that "The tongue is in effect a double-barrelled tube, supposed to be used to suck the sweets of flowers" (p. 458); while that painstaking anatomist, for whom I have always entertained a great admiration, W. MacGillivray, writes in the fourth volume of Audubon's "Birds of America" in referring to the same subject, that "The tongue, properly so called, moves in a sheath, as in the woodpeckers: its length is ten-twelfths. When it is protruded, the part beyond this at the base appears fleshy, being covered with the membrane of the mouth forming the sheath; but the rest of its extent is horny, and presents the appearance of two cylinders united, with a deep groove above and another beneath, for the length of three-twelfths, beyond which they become flattened, concave above, thin-edged and lacerated externally, thick-edged internally, and, although lying parallel and in contact, capable of being separated. This part, being moistened by the fluid of the slender salivary glands, and capable of being alternately exserted and retracted, thus forms an instrument for the prehension of small insects, similar in so far to that of the woodpeckers, although presenting a different modification in its horny extremity, which is more elongated and less rigid. All observers who have written on the tongue of the hummingbirds, have represented it as composed of two cylindrical tubes; and the prevalent notion has been, that the bird sucks the nectar of flowers by means of these tubes. But both ideas are incorrect. There are, it is true, two cylindrical tubes; but they gradually taper away toward the point, and, instead of being pervious, form two sheaths for the two terminal parts or shafts of the glosso-hyal portion of the tongue, which run nearly to the tip, while there is appended to them externally a very thin-fringed or denticular plate of horny substance. The bird obviously cannot suck; but it may thrust the tip of the tongue into a fluid, and, by drawing it back, may thus procure a portion. It is, however, more properly an organ for the prehension of small insects, for which it is obviously well adapted, and, being exsertible to a great extent, enables the bird to reach at minute objects deep in the tubes and nectaries of flowers. That a humming-bird may for a time subsist on sugar and water, or any other saccharine fluid, is probable enough; but it is essentially an insect-hunter, and not a honey-sucker."

During the past year the writer has made a large number of dissections upon a great many species of humming-birds, both adult specimens and embryos; and it has proved his good fortune to fully confirm the researches in this direction made by MacGillivray.

In examining into the real facts in the case, the writer would advise the investigator to proceed in the following manner. Having secured a fresh adult specimen of any of our hummers, and placed it in alcohol for an hour or so, in order to sufficiently harden the tissues for our dissection, carefully skin the head.

We have no trouble in finding at once the *epibranchials* on top of the head. By the use of a sharp knife, these can easily be lifted from their position, and finally with a little care the entire tongue removed from the head. We next bring to our aid a lens of some considerable power; and after having examined our specimen, and carefully compared it with MacGillivray's account, which I quoted above, we may insert the delicate point of our dissecting-knife, and by a gentle motion and a little well-directed force, the horny part of the tongue is easily split clear to its tip. Now our lens at once shows us that the cylinder, although hollow, is *completely filled* by the cartilaginous rod of the *glosso-hyal*, and is in reality *not hollow* at all.

In closing, I would like to say that it must be evident to all that not a single structural character in the entire head of this humming-bird agrees in any way with the corresponding characters in the head of a swift, with which latter birds they, the hummers, have heretofore been associated in the same order in classification. — DR. R. W. SHUFELDT, in *Forest and Stream*.

SCIENTIFIC BREVITIES.

A REMARKABLE SPRING. — A spring at Belten, Mo , contains over 682 grains to the gallon of mineral matter, 109 grains of which are free sulphuric acid.

LIQUEFACTION AND SOLIDIFICATION OF HYDROGEN COMPOUNDS. — K. Olsewski has found that hydrogen fluoride solidifies to a white, crystalline mass at −102°.5 C. The solid melts at −92.3. Hydrogen phosphide liquefies at −90°, and solidifies at −133.5. The solid melts at −132.5, and boils at −85°. Hydrogen-antimonide, prepared by the action of dilute sulphuric acid on an alloy of two parts antimony and three parts zinc, only the first portions of gas being collected, solidifies at −91°.5. As the temperature is raised, it begins to decompose between −65° and −56°, antimony being deposited on the walls of the tube. At −18° this decomposition take place rapidly. It is not, then, difficult to understand why such small proportions of hydrogen-antimonide are obtained at ordinary temperatures.

THE PURCHASE OF THE SERPENT-MOUND PARK in Adams County, Ohio, through the efforts of Professor F. W. Putnam, and the plan of its restoration and preservation as a free public park, is an example which is worthy of imitation wherever there is an historic place or building to be preserved. Serpent Mound is one of the most wonderful of many gigantic works of an unknown race, scattered through the Mississippi Valley and in other portions of the country; and it will be a matter of congratulation to readers interested in the antiquities of our country, to know that it has been rescued from the plough of the husbandman, and that its outlines can be preserved for future generations. Professor Putnam has just concluded negotiations for that portion of the farm on which the mound is situated, embracing an area of about sixty acres, which is placed in charge of the Peabody Museum in Cambridge.

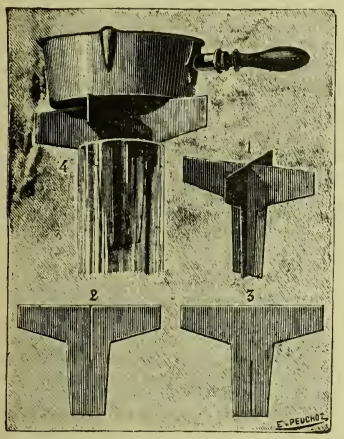
NECTAR-GLANDS OF FLOWERS. — Professor Delpino, who as early as in the year 1873 announced the idea that most extra-floral nectar-glands in plants are useful to the plants that bear them, by attracting a body-guard of ants, has now published the first part of an elaborate memoir on the topic. The number of species recorded as having extra-nuptial glands is much larger than would have been expected. This term "extra-nuptial" is coined to distinguish the glands under consideration from certain extra-floral glands which, no less than those in the flower, are subservient to pollination. The service performed by the ants so attracted and fed is the keeping-off of caterpillars and other insects which prey upon the foliage, young fruits, etc.

Practical Chemistry and the Arts.

A SIMPLE OIL-STOVE.

The illustration shows a cheap and convenient support by which a common kerosene-lamp may be utilized for heating water, making tea or coffee, or cooking small quantities of food.

Two pieces of sheet-metal — copper is best, but tin or iron will answer very well — are cut into the forms represented in Figs. 2 and 3. A slit is cut half way through each piece, — in one from the top, and in the other from the bottom, — so that they can be joined together,



as in Fig. 1. This can then be placed in the top of a lamp-chimney, and, without interfering with the light, can be used to support a small dish or other utensil, in which water or other liquids can be quickly heated. Care should be taken to set the support on the chimney only when it is cold, and to heat slowly: otherwise there is danger of the cold metal cracking the chimney by conducting the heat away from it too rapidly.

A NEW PROCESS FOR COLORING COPPER AND NICKEL.

The following process is given in the *Journal des appl. électriques*, by which, it is claimed, eleven different tints can be produced upon copper, and eight upon nickel. The articles are thoroughly cleaned and polished, and placed in the following solution: —

Acetate of lead	31 grains.
Hyposulphite of soda	93 "
Water	1 quart.

The bath must be heated nearly to the boiling-point before the copper or nickel articles are placed in it, when a grayish tint is first produced, which changes successively to violet, chestnut brown, red and blue, including the intermediate shades. When any desired color is obtained, the articles are withdrawn from the bath, washed, dried, and varnished. This process is especially adapted to the coloring of buttons, or similar small metallic articles.

ON METALLIC MANGANESE.

A short time ago, I had occasion to examine a specimen of commercial metallic manganese. I found that it was not visibly affected by a powerful compound horse-shoe magnet. I then carefully rubbed some to a very fine powder in an agate mortar, as I had reason to suspect the presence of particles of iron when powdered in a steel mortar.

A little of the powder was sprinkled on a thin sheet of well-glazed paper, placed over the same magnet. When the paper was gently drawn laterally or lengthwise to the direction of the poles, a few particles were seen to be strongly drawn out from the rest, whilst the greater portion seemed unaffected: this was evidently not due to mere differences of inertia in the particles.

A steel-pen nib was then strongly magnetized, and the point drawn through the powder: the attracted particles gathered in small tufts, and behaved as though they were capable of faintly attracting other particles.

Manganese made by Brunner's method is said to be non-magnetic; and as this statement occurs in "Watts's Dictionary" with the editorial query, my curiosity was, so far, at least pardonable.

Ten grams of the metal were dissolved in dilute hydrochloric acid with a piece of platinum foil thrown in, so as to expedite the solution. A residue amounting to about twelve per cent was left undissolved, consisting apparently of silica, carbon, and fluor-spar: the whole was transferred to a porcelain dish, so as to burn off the carbon, when a copious inflammable vapor was given off, burning with a strong, smoky flame.

The presence of this inflammable vapor may admit of explanation in this way: that the oxide, flux, and reducing materials were heated in the vapor of light petroleum so as to avoid the ingress of atmospheric oxygen; or, as Deville has pointed out, it may arise from the rock-oil adhering to the sodium, which is used by Brunner in its preparation from the chloride.

The metal obtained from the chloride or fluoride by Brunner's process has also the aspect of cast-iron, and is very brittle, but it is not magnetic.

As Sir William Thomson has recently pointed out that petroleum is capable of affecting a magnet, I thought that the presence of this vapor might have something to do with its magnetic indifference. The powdered metal was carefully heated for some hours over a gas-blower in a piece of combustion tubing, through which a current of hydrogen was passed, and the metal allowed to cool in a current of the same gas. A slight increase in weight was observed, and the portion of the tube near the porcelain boat was dimmed by the action of fluorine or a volatile fluoride; but no condensed petroleum was collected, although the smell was distinctly perceptible.

I must remark, however, that this result of heating is unsatisfactory, and showed that a little air must have crept into the tube. The experiment should be repeated with the necessary precautions to guard against the intrusion of air or moisture. This heating did not produce any marked change in its magnetic behavior.

The hydrogen which was given off when the metal was dissolved in hydrochloric acid, gave a peculiar smell, which at the time was attributed to electrolytic hydrogen. I have reason now for believing that the smell was due to the evolution of a carbide of hydrogen.

Since putting these notes together, I have examined this manganese by the attraction upon it when placed in the pan of an analytical balance; and I find that it is distinctly magnetic, although decidedly low. I cannot say, from experience, whether it is abnormal in this respect to manganese prepared by any other process. I have always been under the impression that manganese is but feebly magnetic.

The chemical treatment of this subject has led to the important conclusion, that, knowing the susceptibilities of two or more materials, we can calculate what may be expected when they are mixed together.

Manganese, chromium, cerium, titanium, and osmium are placed by Faraday in the magnetic class, because certain of their compounds exhibit the ordinary magnetic relations.

When we consider that with a delicate balance, we can detect a force amounting only to a five-hundredth grain, we must admit we have at once a simple and delicate method of measuring magnetic forces. A balance turning with a one-hundredth grain will be delicate enough for most purposes.

T. B. Warren in *Chemical News*.

ELECTRICITY ON TRAMWAYS.

Before an electro-technical club in Berlin, Herr J. L. Huber recently read a paper in which he gave some interesting details regarding the cost of working with storage-batteries on the Hamburg Street-Railway, of which line Herr Huber is the engineer.

In order to obtain trustworthy results, experiments were undertaken on a specially difficult line, both as regards curves and grades, which, in addition, crossed much frequented streets, so that all the difficulties met with in railroad traffic in populous cities were encountered. Herr Huber states, regarding the durability of the storage-battery employed, that deterioration takes place only in the positive plates; and this is the more pronounced the greater and more frequent the normal strength of current for which the plates are designed is exceeded. With a well-regulated management, over 20,000 kilometers (12,500 miles) can be run before renewal becomes necessary. A car which, including passengers and storage batteries, weighs about 7 tons, and which is to ascend grades of 30 per cent, such as occur on the Hamburg line, requires 800 kilograms of active material in the positive plates; and its renewal, including the cleaning of the grids, which can be used over again, as they are not oxidizable, costs 4 pfennigs (1 cent) per kilometer run. That would be 1.6 cent per car-mile for renewal of plates. Under the same conditions, the motive-power required is $\frac{3}{4}$ horse-power hour per kilometer ($\frac{3}{8}$ mile) run. The cost for attendance, oil, maintenance, etc., for one-horse power, is 2 cents; consequently this cost per car kilometer is $1\frac{1}{2}$ cents. To the above items must be added the maintenance, oil, etc., for the motor on the cars, which amounts to $\frac{1}{2}$ cent, and contingencies run up to an additional $\frac{1}{4}$ cent. The total cost, with the conditions given, is estimated at 5.6 cents per car-mile. Comparing the cost of electric traffic with that of horses, Herr Huber states, that to operate the usual one-horse car, which, including driver and conductor, carries 26 persons, 7 horses are required on the same line. So that, as the electric car carries 31 persons, $8\frac{35}{100}$ horses would be necessary. The cost of maintenance for one horse during the last year amounted to 50 cents per day per horse, so that the cost amounts to 6.4 cents per car-mile. It follows, therefore, that even to-day electricity is more economical than horseflesh; and the cost of the former can be considerably reduced by improvements. The results of experiments show that 88 per cent of the energy stored in the accumulators can be drawn out, and Herr Huber only counts upon 80 per cent for safety; that is to say, that, of the electrical energy delivered by the dynamos, 20

per cent is lost by the use of accumulators; and this is independent of the length of the line and the power required upon the same, such as the overcoming of grades, etc. It is to be remarked, also, that any car-driver can be employed; and no trained men are necessary, as is the case with locomotives, so that the expense of trained hands is avoided. The above are the results of experiments which were carried out from the end of May to the end of December of last year with a public passenger-car, and the distance travelled amounted to 12,000 kilometers (about 7,500 miles). As these experiments were undertaken in public traffic on an ordinary horse-road, difficult by its grades, and not upon a road specially constructed for the purpose, Herr Huber is of opinion that the life, and power of competition, of the storage-battery are definitely assured. — *English Mechanic.*

DANGER FROM GAS-METERS.

A writer in *The Engineer* calls attention to the danger from gas-meters in case of fire, as follows: — "The meters which gas-companies introduce into our houses are put together with solder that melts at a low degree of heat. When a fire originates near a gas-meter, the heat very soon causes it to fall apart, and the unchecked flow of gas from the influent pipe quickly fills the premises with a roaring and devastating flame. After every fire, when there is a total loss of the building, a blazing stream of gas roars on beneath fallen walls and *debris*, until measures are taken to stop the supply of gas from the street-mains. With these facts before everybody's eyes, it seems strange that no attempt is made to have meters differently constructed, or some way devised to prevent the loss that necessarily results from the preseut state of things. A stopcock might be put into the influent pipe at a point outside, where the firemen or janitor or watchman could cut off the flow from the street. Or, an automatic attachment might, at small cost, be so arranged, that, when the temperature rises dangerously near to the degree of heat which would open the seams of the meter, a spring or a weighted lever would be released, and operate to cut off the gas at that point where the usual key for that purpose is provided.

"The danger is multiplied in the apartment-houses and in the heavenward-aspiring office-buildings with which New York and many other cities are being so abundantly provided. It was only the other day, when, having occasion to visit the lower regions of the building of one of our leading fire-insurance companies, we saw gas-meters ranged against a wall, tier above tier, to a height of perhaps fifteen feet, and numbering fifty or more in all, of all sizes. They were practically on a wall of the boiler-room. A partition of rough wood made a narrow hall-way in front of this battery of incendiaries, and masked it; but the wood was as dry as possible, and the inevitable result of its taking fire would be to liberate a great volume of gas that would fill the whole building, and, mixing with the atmosphere, would form a compouud as explosive as nitro-glycerine, and just as destructive in its effect."

EFFECT OF IMPURITIES IN GOLD ALLOYS.

The way in which an alloy of gold and copper is affected by a small quantity of impurity presents one of the most serious difficulties in working gold. It has been known since the seventh century, that minute quantities of certain metals render gold brittle; and in a recent lecture at Birmingham, Eng., Professor Austin Roberts said: "It may be well to demonstrate the fact. Here are some sovereigns: I will melt them, and will add, in the form of a tiny shot, a minute portion of lead amounting to only the 2,000th part of the mass, first, however, pouring a little of the gold into a small ingot, which we can bend and flatten, thus proving to you that it is perfectly soft, ductile, and workable. The rest of the mass we will pour into a bar; and now that it is sufficiently cold to handle, you see that I am able to break it with my fingers, or at least with a light tap of a hammer. The color of the gold is quite altered, and has become orange-brown; and experiments have shown that the tenacity of the metal — that is, the resistance of the gold to being pulled asunder — has been reduced from 18 tons per square inch to only 5 tons. These essential changes in the property of the metal have been produced by the addition of a minute quantity of lead."

THE ADJUSTMENT OF DELICATE BALANCES.

A correspondent of an exchange says: "Some time since, my attention was drawn to the fact that rubbing the glass casing of the balance used for weighing gold and silver buttons, threw the same out of adjustment.

"I find, on experiment, that the effect of even drawing a handkerchief across the glass of the sliding door in front is very evident, the balance being acted upon to such an extent as to make an apparent difference of over one milligram between the weights of the pans. Upon throwing up the sliding door, the balance returns to its proper condition, and works accurately; but, the moment the door is drawn down, the same difference is observable; the beam being tilted, so that one pan is on the rest, and the other in the air. This condition of affairs will continue until the glass is discharged by breathing upon it, and touching with the fingers or some conductor of electricity.

"As the casings of laboratory balances are always liable to become dusty and soiled, necessitating cleaning from time to time, the above may sometimes be the cause of their being difficult to re-adjust."

INDUSTRIAL MEMORANDA.

Great Guns. — The biggest piece of artillery ever made by Krupp is a 16-inch gun just finished at Essen. The effect of a shot from this gun is said to be the most destructive known. The shot easily pierces the most strongly armored iron-clad at close distance. It also passes clean through an armor-plate of 38.8 inches thickness at a distance of 3,000 feet. Another of Krupp's latest productions, a quick-firing gun on the pivot system, is also very highly spoken of, its performances being such that no torpedo-boat could possibly withstand it or escape.

Gigantic Cotton-Mill Engine. — Messrs. Douglas and Grant, Dunnikier Foundry, Kirkcaldy, have at present in hand a compound Corliss engine of a very large description for a cotton-mill in Bombay. The high-pressure cylinder of this large engine is 40 inches diameter, and the low-pressure cylinder 70 inches, each having a stroke of 6 feet. The fly-wheel, which weighs about 110 tons, is 30 feet in diameter by 8 feet 6 inches wide, grooved for 38 ropes, by which the power is to be transmitted to the various lines of shafting in the mill. The engine is to run at 60 revolutions per minute, giving a speed of ropes of considerably over one mile per minute. The crankshaft, made of Whitworth fluid compressed steel, is 25 inches in diameter in the body, and 20 in the bearings. The steam-pressure is to be 100 pounds per square inch, and the engines will work easily up to 2,500 horse-power.

The Commercial Manufacture of Chlorine. — A short time ago, Mr. L. Mond of London introduced and patented a process for obtaining this gas from chloride of ammonium, and he now makes known his method of extracting and recovering it from gaseous hydrochloric acid. The hydrochloric acid gas is brought into contact at an elevated temperature with protoxide of nickel or certain oxides or salts, or substances containing the same: the chlorine combines with the base, and vapor of water is given off. This can be used in making bleaching-powder, or other purposes. Only a certain number of the oxides and salts which can be employed for obtaining chlorine from chloride of ammonium are applicable, and more especially the oxides and salts of those metals which only form one oxide each, as magnesium, zinc, aluminium, and of those metals which at the elevated temperature employed form in a current of air their monoxide only, such as nickel, cobalt, etc.

Transparent Molten Iron. — Mr. W. Ramsay has observed that the molten iron seen during a casting of several tons is transparent. It was possible to see bodies through the stream of metal, they taking, however, a yellow tinge. The observation is one of much interest; and perhaps others engaged in the iron industry will be able to confirm it, since it is hardly likely that the phenomenon has not been witnessed before.

An Intelligent Engineer. — A writer in an exchange says: "I have had as much experience of the Chinese laborer as most people; and the result of it is, that while you can teach him any thing except morality, he never originates any thing, and is all at sea in an emergency. One instance of originality I can recollect. While seated in a rickety old steam-launch about to start for a thirty-mile trip up a river swarming with crocodiles, I overheard the Chinese engine-driver explaining the engine to a Malay who was asking the use of the pressure-gauge. "Then," said the latter, pointing to the 150 at the end of the scale (the stop-pin was gone), "when the hand gets there, you stop?" — "No," said the Chinaman, with a grin of superior knowledge: "*it goes round again.*"

Coal Product of 1886. — 107,682,209 tons of coal were mined in this country during the past year, the estimated value of which was $147,112,755.

Utilization of Coke Dust. — Recently the Gas Company of Lyons, France, have introduced very successfully a system for the utilization of fine coke dust, by transforming it into briquettes, for which they have a great demand at the Perrache Works. These coke-fines are first washed, to separate from them all slate or other impurities: they are then dried, and heated to about 200° F., and are mixed with 150 pounds of coal-tar pitch, previously ground and heated, for every ton of coke-fines. To this is then added 50 pounds of coal-tar, and the whole mass is then fed to a compressing machine, which turns out the finished briquettes. The total cost of this work at Lyons amounts to $4 a ton, and the product finds a ready market at from $5.50 to $6 per ton. The cost of the whole plant, having a capacity of sixty-five tons per day, only amounted to $9,000.

Postal-Cards. — At the factory at Castleton, there are manufactured between two and three tons of postal-cards a day all the year round. The largest order ever filled for one city was 4,000,000 cards, or about twelve tons of paper, for New York. They use about 6,000,000 cards a month. Chicago comes next, with about 3,000,000 cards in the same period. There are 450,000,000 postal-cards manufactured annually, and their use is increasing daily.

Home, Farm, and Garden.

[Original in *Popular Science News.*]

THE MYSTERIES OF PLANT-GROWTH.

BY FRANCIS WYATT, PH.D.

VII.

A HUNDRED years ago, phosphorus was little more than a scientific curiosity, and, until the invention and vulgarization of matches about 1840, was comparatively neglected, even by chemists.

No one seemed to know of or care any thing about its abundance in nature, or of the preponderating influence it exercises on the existence of every description of organized life; and less than any other class, did agriculturists dream of its fertilizing value, or realize that without it, animals and vegetables would soon come to an end.

No one suspected that the health and activity of our brains and nerve-centres depend upon its presence in given quantity, and that the whole of our bones, like those of all living things, is made up of phosphorus and lime; and it is only within the past forty years that experiment has slowly dispelled our appalling ignorance.

We now know, that when allowed to burn in the air, phosphorus unites with oxygen to form a white powder called phosphoric acid, which, being a very unstable compound, seizes with avidity sufficient moisture from the atmosphere to become a liquid of a sirupy consistency. In this state, its chemical composition consists of one molecule of pure phosphoric acid, with three molecules of water; and if it be placed in contact with lime, or any other suitable base, it combines, with much heat, to form one of three separate compounds, according to the relative proportion of the bodies brought together. Each of these compounds is a phosphate; but each has a different constitution, and bears a special name. Thus, taking lime as an illustration, we have, —

FIRST, *Acid, or Mono-calcic Phosphate*, produced by mixing 28½ parts of lime with 100 parts of the liquid; or, in other words, by replacing one of the three molecules of water by one molecule of lime. This salt is entirely soluble, and contains, when pure, in every 100 parts, —

Phosphoric acid (P_2O_5)		52.59
Lime (CaO)		20.74
Water of constitution ($2H_2O$) .	13.335	
Water of crystallization ($2H_2O$)	13.335	26.67
		100.00

SECOND, *Neutral or Bi-calcic Phosphate* — more commonly known in commerce as precipitated phosphate — produced by mixing 57 parts of lime with 100 parts of the liquid; that is to say, by replacing two of the molecules of water by two molecules of lime. When much water is present, this salt takes up 4 molecules in its crystallization; but by subsequently heating it to about 250° F., two of these may be driven off, and each 100 parts will then contain, —

Phosphoric acid (P_2O_5)		46.20
Lime (CaO)		36.30
Water of constitution (H_2O) .	5.85	
Water of crystallization ($2H_2O$)	11.65	17.50
		100.00

THIRD, *Basic or Tri-calcic Phosphate*, produced by mixing with the 100 parts of liquid, 85½ parts of lime, and thus entirely replacing by the latter the original three molecules of water. When freshly prepared, it has the appearance of a light and gelatinous precipitate, which may be dried at a high temperature, or even calcined without undergoing any chemical change. It is entirely insoluble in water, and its invariable composition in 100 parts is, —

Phosphoric acid (P_2O_5)	45.80
Lime (CaO)	54.20
	100.00

Phosphorus owes its origin to the earth, probably as phosphoric acid; but as this body has no separate existence in nature, it is invariably met with combined as phosphates. These are dissolved in the water of the soil by the carbonic-acid gas and some mineral and organic agencies, and conveyed thus to the interior of plants through their roots.

In a recent work, I have shown that, in the spring-time, phosphates are found in noteworthy quantities in young organs of plants, especially in the leaves; but the quantity gradually diminishes as the plants approach maturity, until, when the blossoms appear, the phosphates are found to have entirely quitted the leaves, and accumulated in the seeds. This is the cause of that peculiar effect which has long puzzled farmers, — that fodder cut and brought in after the period of maturity, proves to be much less nourishing to the cattle than that cut before this period has arrived.

It is worthy of note, that, in every instance, this displacement of the phosphates is accompanied by an equal displacement of the nitrogen; and all those who have made successive analyses of grains in various stages of maturity, must have been struck by the regular parallel manner in which the proportions of both have progressively augmented. In his work upon the migrations of phosphorus in vegetables, Mr. Corenwinder, alluding to this phenomenon, remarks: "It has long been known that young buds are rich in nitrogenous matters, which are always accompanied by a relatively considerable portion of phosphorus; and there is no doubt that these two elements are somehow united in the vegetable kingdom by some mode of combination which is yet a mystery."

In his very remarkable experiments at Grignon, in France, Deheran discovered that when finely ground wheat, corn, or peas are treated with pure or acidulated water, they all yield up a considerable proportion of phosphoric acid; and that, if the flour is then dried and calcined, a still further quantity remains in the ash. The total being more than sufficient for combination with the coexisting earthy or mineral bases, he assumes that the phosphates secreted by vegetable organisms are of two kinds: —

(*a*) Those which are insoluble before calcination, and which are combined in some, as yet mysterious, way with their own substance.

(*b*) Those which have been deposited in their tissues by the evaporation of the water holding them in solution, when it filtered through their roots.

The manner of the first combination will be best illustrated by a few simple demonstrations.

A porous jar nearly filled with distilled water is set in a deep dish containing a solution of sodium sulphate, in such a manner that the two liquids are exactly level. Although no mechanical mixture is made, the sodium sulphate will penetrate through the sides of the porous jar, and so pervade the distilled water, that, at the end of a few days, the strength of the two liquids will be identical. Thus, independently of the exterior fluid, its salt may be systematically transferred through a porous body — such, for instance, as the root of a plant — into another fluid, such as the sap. If, to continue our experiment, we add to the outside solution a sufficiency of potassium chloride, we shall find that, as in the first instance, it will soon pass into the interior liquid; and this proves that the presence of one salt in no wise prevents the complete diffusion of another.

Let us now assume, for the sake of argument, that the potassium chloride, on entering the porous jar, is acted upon and transformed by some agency into an insoluble salt. This salt will fall and accumulate at the bottom, and the interior solution will therefore be impoverished; but, as new quantities continue to arrive from the exterior vessel, the equilibrium, although constantly disturbed, is as constantly restored. The practicability of this accumulation of one element in preference to another, consequent upon some decomposing influence, may, at first sight, appear doubtful; but it may be readily exemplified by placing in the outer dish a solution containing common salt and sulphate of copper, and by occasionally dropping into the distilled water in the porous jar, small quantities of baryta water; when all the sulphate of copper will finally be found in the interior vessel.

Applying these arguments to natural phenomena, we may very reasonably suppose, that in the tissues of a vegetable, this preferential accumulation of one particular substance is induced by somewhat similar causes. When a young plant commences to grow, its organs are rich in nitrogenous principles, which have the faculty of decomposing phosphates, and reducing them to insoluble compounds. If, therefore, a mixture of various phosphates and chlorides — say, for instance, common salt — be held in solution by the water surrounding its roots in the soil, the plant will avail itself of each substance according to its requirements, and in different proportions. The phosphates will enter into the sap by diffusion, and, being acted upon by the existing nitrogenous principles, will become insoluble, and be precipitated. As fresh quantities of nitrogenous principles are generated, this action will be maintained, and the result will be accumulation. With the common salt, no such effect is possible, for the simple reason that its presence is confined to the sap, where its proportion is, at least, as great as that of the exterior moisture; and hence, there is neither room for its diffusion, nor necessity for its continued admission. And it is generally well known, that many plants grown in a saline liquid, will absorb the water, and leave the salt. The absorption of phosphates, therefore, takes place independently of the exterior and interior liquids, because of the influence of chemical action; while that of chlorides, in the absence of such action, is restricted to the quantity necessary to saturate the sap.

Coming now to the second form of their existence, — i.e., that in which they are free, and may be eliminated by either pure or acidulated water before calcination, — I think it must be accounted for by the fact, that, although the phosphates of the soil are insoluble in pure water, they readily dissolve when that water is charged with carbonic-acid gas. This may be at once demonstrated by another simple experiment: —

An equal mixture of common table-salt and bi-carbonate of lime is dissolved in a tumbler half full of distilled water. Several narrow strips of muslin or cloth are hung around the interior from the rim. When these strips are completely saturated, the bi-carbonate of lime they have taken up is exposed to the action of the air, and, losing one of its molecules of carbonic acid, is at once reduced to the form of insoluble carbonate. Their upper extremity consequently becomes poorer in bi-carbonate than the end bathed in the solution. This induces diffusion; and fresh quantities continually come up to the surface, which are similarly decomposed and precipitated as they arrive.

Upon the table-salt, no such chemical action is exercised; the only change that takes place in its case being, that the liquid, impregnating the strips, becomes more concentrated than that in the glass, owing to repeated evaporation. If an analysis of

the original solution be made at the end of a few days, it will therefore be found, that whereas only about twenty per cent of the table-salt has been taken up by the strips, no less than sixty or seventy per cent of the bi-carbonate of lime will have been decomposed. This reaction is just as applicable to natural phosphates as to carbonate of lime, because, although equally insoluble in pure water, both dissolve in carbonic acid, and each would reassume its insoluble form with the evaporation of that gas.

The necessary proportion in which phosphoric acid must be present in a soil, entirely depends upon the nature of the crops it is desired to cultivate, as the following table will show: —

Phosphoric Acid absorbed per Acre of Land by —	
100 Bushels of corn (ears and stalks)	80 lbs.
1 Ton cotton-fibre	60 "
100 Bushels potatoes	52 "
20 Tons turnips	45 "
30 Bushels wheat (ears and straw)	30 "
35 Bushels rye	25 "
50 Bushels oats	18 "
30 Bushels barley	18 "

If, therefore, at least, these proportions do not exist, the plants will languish: their stems will want solidity, their seeds will have little weight, and death will ensue before they reach maturity.

Various malignant diseases will declare themselves, — *rust* in the cereals; *oidium*, *phylloxera*, and *mildew* in the vines; *perisporium solani* and *peronospora infestans* in the potato; *worms* in the beet, etc.

As the phosphoric element is so indispensable to all vegetable production, that, without it, no good crops can possibly be raised, it very naturally follows, that, of all ingredients, it is the quickest absorbed from, and therefore most deficient in, cultivated soils; while, to make matters still more complicated, its occurrence, though so *plentiful* in nature, is found to be most unequal.

It does not exist in the atmosphere; soils of the granitic and tertiary formations are nearly deprived of it; and many other species only contain very slight traces.

The principal and most available commercial sources of phosphates for agricultural purposes, may be stated as follows: —

First, Natural phosphates, of animal or mineral origin; such as bones, bone-ash, animal-charcoal coprolites, phosphorites, and apatites.

Second, Superphosphates, manufactured by treating any of these raw materials with a sufficient quantity of sulphuric acid to transform two moleeules of their lime into sulphate.

Third, Precipitated phosphates, obtained by dissolving raw phosphates in hydrochloric instead of sulphuric acid, and adding to the liquid a milk of lime, which throws down a bi-calcic compound already described.

Fourth, The very finely powdered phosphoretic slag, obtained as a by-product in the manufacture of steel, by the basic process of Thomas and Gilchrist, and now assuming immense importance in European countries.

From which of these forms the most direct advantage is to be obtained by the farmer, is a question which several volumes might be profitably written to answer. I shall, therefore, not attempt more than a few general considerations, and shall endeavor to be as brief as may be consistent with lucidity. Accepting the generally admitted and rational theory, that no element can penetrate into the interior of a plant unless it be in the form of solution, it naturally follows that preference will be invariably given to those commercial phosphates which are most readily subject to dissociation; and this will entirely depend upon two conditions: —

(*a*) Their own degree of aggregation.

(*b*) The nature and composition of the soil in which they are employed.

The first thing to be attained is, undoubtedly, a fineness of pulverization, which will so divide the molecules as to render them easily decomposable by the natural action of the elements contained in the ground; and in this we have hitherto only partially succeeded by mechanical means. So long ago as 1851, Liebig recognized the difficulty, and proposed, in order to solve it, to chemically perform this operation by manufacturing superphosphates; and from the stand-point of disintegration, this method has been entirely satisfactory, and has enabled agriculture to rapidly obtain results from the use of phosphoric acid which would otherwise have been impossible. From a chemical point of view, however, the whole theory fails; since we know that superphosphates are only soluble in water so long as the sulphuric acid retains its ascendency over the lime, and that when they reach the soil, especially where carbonates are in abundance, the sulphuric acid is at once overpowered, and the phosphoric acid, unable to exist in a free state, is taken up by the lime and iron, and at once reverted to a tribasic form. In other words, the whole question is one of time, and of dollars and cents. The farmer buys a ton of raw tri-calcic phosphate, finely ground, and containing twenty-five per cent of phosphoric acid, for $10; and if his land contains neither humus nor acid elements, nor a sufficiency of lime, he will have to wait, perhaps several years, before obtaining any appreciable results from his outlay. On the other hand, he buys a ton of superphosphates, containing only fifteen per cent of phosphoric acid, for $15, and, applying it to an exhausted soil, produces the desired result on his next crop. Hence, it is apparent that the phosphoric acid of the latter is more assimilable than that of the former case; and this assimilability can only be due to the absolute state of division insured by the series of decompositions to which the basic salt is exposed during the manufacturing process. To define with scientific accuracy the exact merit or intrinsic value of any specified phosphate, is a matter of very serious difficulty; since, besides that of its own physical condition, so much depends upon the nature and composition of the soil in which it is to be employed. No better examples of this truth could possibly be found, than the preliminary comparative experiments, conducted during the past two years, with raw basic slag, and various other phosphatic materials; for they have so far proved, that whereas, in some soils, effects are produced by crude phosphates fairly rivalling those obtained with superphosphates, in other soils they are either quite inert or insignificant in their action.

THE EARLY INHABITANTS OF AMERICA.

Dr. Daniel G. Brinton, in a lecture delivered at the University of Pennsylvania, said: "The early Americans were representatives of the stone age in most cases, although a few possessed the knowledge of metals. They were particularly clever stone-workers, and the samples of their craftsmanship show them well versed in the arts of the potter. In clay-moulding they were also skilful. The textile arts were practised, such as cotton and wool spinning and weaving. Cotton was extensively raised in Mexico and Yucatan, and two species of goats were acclimatized to Peru for the sake of their wool." As to their architectural methods, the lecturer said they were not familiar with the plumb-line, but adjusted their building materials merely by the eye. They were familiar with two kinds of arches, also square and rounded pillars. The lecturer called attention to the love of music that prevailed, and the astronomical progress that our American forerunners seem to have reached. They learned the length of the solar year, and in their leap-years made provision for the necessary "extra day." They pursued thorough agricultural methods, and practised fertilization and irrigation.

Dr. Brinton further referred to the extensive commerce which prevailed among the American races, and closed with a mention of their love for sports and outdoor games. Early American art in general, the lecturer criticised as much below that of ancient Egypt and Assyria in point of appreciation of the beautiful. — *Philadelphia Medical and Surgical Reporter.*

HOUSEHOLD HINTS.

Killing Fowls. — Tie up the birds by the legs, using soft cord for the purpose, so that it will be just level with the operator's breast. The bird is first stunned by a blow on the head, and then the windpipe is severed with a sharp knife. The blood flows freely; and the action of the wings, left loose for the purpose, help in that direction. In a very short time muscular action ceases. We have been assured by those who ought to know, that this is the most humane method of killing fowls.

Dry Cellars. — In dealing with a cellar in springy ground, the first thing to be done to make it dry, says the *Sanitary Engineer*, is to provide some chance for the water to run away before getting into the cellar. This may be done by laying a two-inch tile drain-pipe in a trench dug all around the foundation outside of the walls, and from one foot to two feet below the cellar-floor. Put this pipe together without mortar, and cover it with cobble-stones to keep out the dirt and sand. If it is not practicable to lay the drain outside, it may be laid inside of the cellar-walls, directly in the cellar-floor; but the operation of such a drain is less efficient. The back-filling of the cellar-walls should be porous enough to allow the water to go directly into the drain.

Chocolate Macaroons. — Melt over a slow fire, and in a tin pan, three ounces of chocolate without sugar; then work it to a thick paste with one pound of pulverized sugar and the white of three eggs. Roll the mixture down to the thickness of about one-quarter of an inch; cut it in small round pieces with a cutter, either plain or scalloped; butter a pan slightly, and dust it with flour and sugar, half of each; place the pieces of paste, or mixture, in, and bake, in a hot but not quick, oven; serve cold.

The Shrinkage of Flannel. — To keep flannels as much as possible from shrinking and felting, the following is to be recommended: Dissolve one ounce of potash in a bucket of water, and leave the fabric in it for twelve hours. Next warm the water, with the fabric in it, and wash without rubbing; also draw through repeatedly. Next immerse the flannel in another liquid containing one spoonful of wheat flour to one bucket of water, and wash in a similar manner. Thus treated, the flannel becomes nice and clean, has barely shrunk, and almost not at all felted.

Flour is like butter: it absorbs smells readily. It should not be kept in a place where there are onions, fish, decaying vegetables, or other odorous substances, or in a damp room or cellar. Keep it in a cool, dry, airy room, not exposed to a freezing temperature, or to one above seventy degrees, and always sift before using.

Boiling Vegetables. — Put them at once into fast boiling water, and bring it to a boil again as soon as possible. If left to steep in hot water before boiling, they are rendered tough, and the color and flavor are destroyed.

The Popular Science News.

BOSTON, SEPT. 1, 1887.

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Any subscriber failing to receive one or more copies of his paper, should report to the publishers, and the missing numbers will be promptly replaced. The Science News *is folded, wrapped, and mailed by special machinery; and, although the greatest care is taken, it is impossible to prevent occasional mistakes, which they are always glad to rectify.*

The following special despatch to the *Science News* from Professor Young, regarding the total eclipse of the sun, will be of interest.

Kieff, Russia, Aug. 19.

Observation a failure; clouds.

C. A. Young.

The unfortunate meteorological conditions which prevented any observation of the eclipse will be regretted by every one, and more especially as the locality and duration of the eclipse were unusually favorable. It is seldom that the limits of totality occur in such proximity to the European centres of civilization; and there can be but little doubt, that, had the weather been favorable, our knowledge regarding the solar envelope would have been greatly increased.

The Ninth International Medical Congress, which is to open in Washington on the 5th of the present month, bids fair to be the largest gathering of physicians that has ever taken place. It is estimated that over five thousand delegates will be present, including representatives from almost every civilized nation. Numerous papers will be read by men of world-wide reputation, and all the leading American and foreign medical journals will be represented. The occasion cannot fail to be of the highest interest and importance.

Early in the month it was reported that Mr. Mayall, a London photographer, had succeeded in taking photographs in the natural colors of the object photographed. The description of the process as given in the daily press was evidently written by a person not familiar with scientific terms, and was utterly unintelligible. As the report has not yet been confirmed, and no rational account of the new method reached this country, it is probable that the new discovery was due to the too active imagination of some newspaper reporter, if, indeed, it was not an intentional hoax upon the public. Photography in colors may yet be possible; but it will have to be accomplished by the aid of scientific principles, of which at present we are entirely ignorant.

A more palpable hoax has been perpetrated by a writer in a Western newspaper, who prophesies the most terrible disasters if the internal pressure on the earth's crust is reduced by the continual boring for natural gas. The article referred to says, that, "if boring for gas is not prohibited, some terrible explosion will turn Central Ohio over like a pancake to the depth of twelve hundred or fifteen hundred feet, and let the waters of Lake Erie come howling down the Ohio and Mississippi valleys, and in their mad career wiping out the central portion of the civilization of the United States." We doubt if the possibility of such a disaster would check a "natural-gas boom" in any Ohio town; and, to make the cataclysm complete, the writer should also have added that this terrible explosion would be followed by Wiggins's long-promised storm, which would finish the work of destruction, and materially change the political situation in season for the next Presidential election.

"Artificial egg color" has attracted much attention lately, as eleven fatal cases of poisoning by it have recently been brought to light in Philadelphia. It appears that this artificial color is composed of chromate of lead, and has been extensively sold to bakers as a substitute for eggs, to produce a yellow color in cakes and confectionery. It is only fair to suppose that the majority of those using it are ignorant of its highly poisonous nature, as one of the Philadelphia bakers lost his wife and six children who had partaken of this chromate-tinted food; but the reckless scoundrel who first placed the stuff upon the market deserves the severest punishment.

It has recently been shown that scarlet-fever may be contracted by human beings from the milk of cows suffering from an allied disease. Cows so afflicted do not present any acute symptoms, and the condition might be easily overlooked. It is suggested that milk about which there is any doubt, should be boiled in order to destroy disease-germs that may be present; and owners of milch-cows cannot be too careful in regard to any slight indisposition among them, but should only sell or make use of milk from animals whose physical condition is above suspicion.

The general re-opening of schools with the beginning of the present month, brings to mind the important matter of overwork among their pupils. There can be no doubt but that the majority of children, in the public schools especially, to complete the prescribed course with credit, must spend more time in study and mental labor than is consistent with their physical welfare. A high standard of scholarship is very desirable, but a sound and healthy body is of vastly more consequence. Dr. Hammond reports the case of a little girl, one of his patients, who brought home from school ten different text-books to study during the evening. No wonder the poor child was "pale and anæmic." Parents should strictly forbid any studying out of school-hours. Let the time be spent in exercise and recreation, even if the lessons go unlearned; and at the end of the school year, there will be no complaints of headaches or "nervousness," which even the rest of the long summer vacation often fails to cure.

BAFFLED INVESTIGATORS.

A party of gentlemen in Philadelphia have, for a year or more, amused themselves in the company of spiritualistic "mediums," so called, and the outcome of their diversions is a book, which is stated to be a "Report of the Seybert Commission on Modern Spiritualism." This volume is remarkable in several respects, but most of all, in its good-nature, incisive sarcasm, and abounding humor. As an addition to the long list of books characteristic of American humor, it is a notable volume; but its claims to be regarded as the reliable results of a scientific investigation of psychical phenomena, will be disputed by hundreds as wise and learned as those of the Commission.

It is known to many, that Mr. Henry Seybert, a wealthy gentleman, and an enthusiastic believer in modern spiritualism, presented, before his death, to the University of Pennsylvania, a large sum of money, with directions that a portion should be used for scientific researches in the field of spiritualism. It is, therefore, to the honest enthusiasm of this gentleman, that the Philadelphia "University Commission" are indebted for a vast amount of diversified amusement.

The Commission appointed to "investigate," is composed largely of professors in the university; but, fortunately, the distinguished Shakespearian scholar, Dr. Horace Howard Furness, was appointed on the board, and has acted as its president. In the absence of this "Report," the outside world would never have known how great a wag and wit the astute and dignified doctor really is. In describing his adventures in hunting up and harboring "mediums," and in his "talks" with apparitions and trance-women, it is shown conclusively that Mark Twain, Bret Harte, and others, must march behind the doctor in the long procession of American humorists.

The learned committee, in this Report, start out with a big joke, in stating, substantially, that they all are fair-minded men, incapable of entertaining prejudice, incapable of doing any injustice, and that one of their number — no less a personage than the distinguished Dr. Furness — "has a leaning *in favor* of the substantial truths of spiritism." The natural result of such unnecessary protestations or statements, is to awaken in the mind of the reader the suspicion that the opposite is really the truth; and this is shown to be well founded by a perusal of the book.

No committee or commission, learned or unlearned, ever reported the results of investigations upon any subject, bringing to view such a spread of melancholy work as this of the Philadelphia professors. They labored night and day for months, in the presence of mediums, strange women, and wizards of all kinds; they took them to their homes, consorted with them, coaxed them, teased them,

but all to no purpose; not a genuine rap or message cheered their despondency; all was fraud, trick, legerdemain.

They had Slade, with his slates; Keeler,

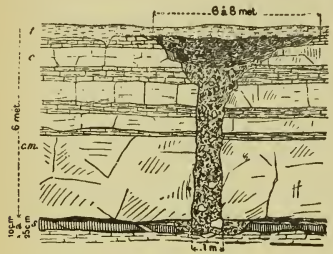

FIG. 1.

with his spiritual photographs; Rothermel, with his tape, ropes, and sealing-wax; Mrs. Lord, with her inspirational eloquence; but they and their works, all alike, are declared to be delusions and shams. They had poor old Mr. Hazard of Providence, the well-known spiritualist, to assist them in their strange and arduous labors; and he, too, was a sham. The venerable gentleman died before this Report was written, so it is safe to place him in any position desired: he cannot reply, unless it be by "raps" from the other side, and these no longer frighten the Commission. The university professors of Philadelphia, and their associate, Dr. Furness, have travelled through a dreary waste,— a waste as sterile as that which met the eye of the *savant* in the romance, who plunged into the hot sands of the African desert on the back of a wild ostrich. They need rest; and that portion of the world which will bestow upon them its applause, and weary them with personal flatteries, should beware. A reasonable time for recuperation is what they have a right to demand before resuming their vexatious labors.

PREHISTORIC FLINT-MINES.

M. MARCELIN BOULE has communicated to *La Nature* a very interesting account of some ancient mines discovered by him near the town of Mur-de-Barrez, in France, from which the prehistoric inhabitants of the country obtained the flint which they worked into weapons and utensils of various sorts. Figs. 1 and 2 give an elevation and plan of two of their mines. They are excavated in chalk, intermixed with flints; but the most valuable flints occur at a depth of about six meters (eighteen feet) below the surface, and it was to reach this bed that the shaft was excavated. The chalk is now being removed for burning into lime; and during the excavations of the modern workmen, these ancient shafts and galleries were uncovered.

One of the most perfect shafts is represented in Fig. 1. At the surface it was from six to eight meters across, but it rapidly diminished to a diameter of one meter (three feet), until it reached the layer of flints, which was from four to ten inches thick. Frequently, after reaching the flint, the works were extended by galleries, branching off through the ground. Fig. 2 gives a plan of one of these galleries, showing the direction taken from the bottom of the shaft. The portion marked by dotted lines has been removed by the modern lime-burners.

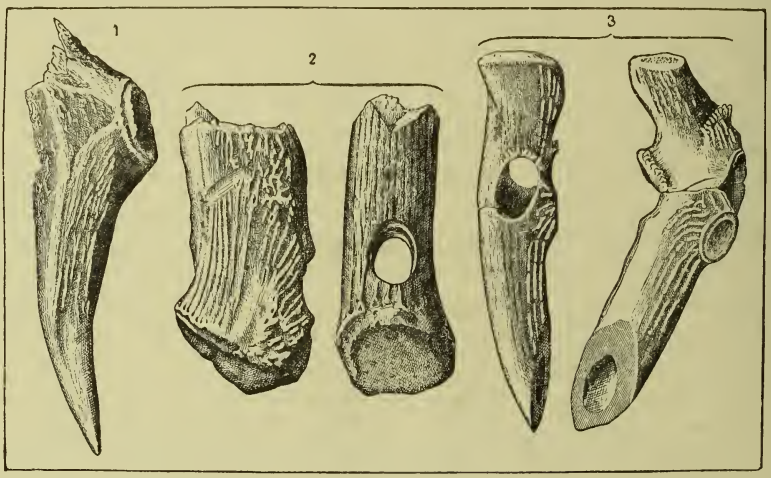

FIG. 3.

The prehistoric miners were acquainted with many of the precautions used in later times, and guarded against the caving-in of their works by leaving pillars to support the roof, or by building artificial supports, just as is done at present. Notwithstanding this, accidents were frequent; and the rude tools of horn have been found, crushed and broken, between the fallen masses of rock.

These tools of the ancient miners (Fig. 3) are quite common, and are of the greatest interest. They are made from the horns of deer, and were usually of the three types represented in the engraving, — comprising the pick, the mattock, and the combination of the two. In Figs. 2 and 3, two faces of the same tool are shown. Fig. 3 is the type most often found. The marks of these rude tools are still visible on the sides of the galleries; and they are sometimes found placed against the walls, just as they were left by the flint-miner when he quitted his work for the last time.

Perhaps the most important relics found in these mines, are the hatchets of polished stone, which show that these workings date from the neolithic age, when man had advanced somewhat from the savagery of palæolithic times, and probably many thousand years subsequent to that period. Metals, however, were still unknown; and the neolithic miner sought for the precious flint with his rude pickaxe of horn, which, with infinite labor, he had perforated, and fitted with a wooden handle, with as much eagerness as the modern gold or silver hunter wields his steel chisels and drills.

M. Boule has found, in the vicinity of these shafts, the remains of ancient workshops, where the flint was worked into various articles of utility; but he thinks that it was more often carried to a distance, and sold or exchanged by a rude system of commerce. In corroboration of this theory, he observes that the mines, or quarries, of flint which have been discovered in Belgium and England, are similar in every respect to those of Mur-de-Barrez. The presence, in Europe, of jade and other minerals not now known to occur nearer than Asia, also points to some such system; and further discoveries may yet prove that the neolithic men were not such savages as they are often supposed to be, but had advanced considerably in the path of civilization.

IN A LABORATORY.

A CHEMICAL laboratory is to many persons a place of mystery, or even terror, which the illustrations in old books, of the dens of the mediæval alchemists, do little to dispel. A visit to a modern analytical labo-

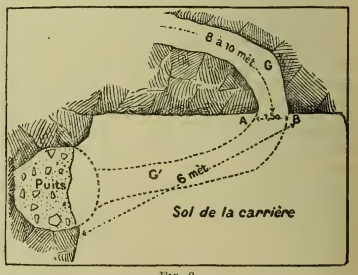

FIG. 2.

ratory would give a very different impression, even to one not familiar with chemistry.

The most striking feature of such a laboratory would be, perhaps, the large number of

bottles, filled with solid and liquid substances, and the quantity of glass utensils, of various peculiar shapes.

Many of the chemicals used in analytical work are so corrosive, that they act vigorously upon metals, quickly dissolving or destroying them; and it is exceedingly fortunate, that, in the cheap and common glass, we have a substance which withstands the action of nearly all reagents. The most useful piece of glass apparatus is, perhaps, the *beaker*, which is simply a cylindrical glass vessel with a flat bottom, shaped much like an ordinary drinking-tumbler, but made extremely thin, so that, when liquids are heated in it, the outer and inner surfaces of the glass will expand together, and thus avoiding the breaking of the vessel.

These beakers are used for innumerable purposes, — of precipitation, evaporation, ebullition, and crystallization. The best kinds are wonderfully strong and tough; and we have often tested them, by heating water in them to the boiling-point, pouring it quickly out, and refilling at once with cold water. Usually, they will stand this extreme test; but, on the contrary, they will sometimes break in the most unaccountable manner, from the opening of a door, or from no perceptible cause. With the usual "total depravity of inanimate things," these breakages usually occur at the most critical point of an analysis; and a careful chemist will, in all important cases, reserve a portion of the material which he is testing, in case the first portion is lost by any such mishap.

For testing small quantities of material, especially where the *quantity* is not to be determined, *test-tubes* are almost always used. These are glass tubes from four to eight inches long, and from a quarter of an inch to one inch in diameter. Like beakers, they are made of the thinnest glass, and are constantly in use.

The visitor to a laboratory would also notice the glass flasks, spherical in shape, and provided with a long neck, in which various gases are generated, and which are used in place of beakers for many operations where a wide-mouthed vessel is not desirable. He would notice the filtering-funnels, and evaporating-dishes, all of glass or the finest porcelain; and perhaps he would see the chemist working over a non-luminous gas-flame, with pieces of glass tubing, bending them into various complicated forms, apparently with the greatest ease; but a single trial would show that there are two ways — a right and wrong — of even bending a glass tube.

What a visitor to a laboratory would *not* see, would be the immense furnaces, stills, and other cumbersome apparatus, of earlier times. The charcoal furnaces have been superseded by the little Bunsen gas-burner; and, even where a greater heat is required, gas is almost invariably used. The modern chemist has little use for stills; and, when one is needed, a glass flask, attached to a compact little piece of apparatus, known as a Liebig's condenser, replaces the retort and "worm" of former days. The visitor need have no fear of being "blown up;" for explosive materials are rarely used, except in special investigations: neither need he fear that his olfactory nerves will be disturbed by disgusting odors, or acrid gases; a prominent feature of every laboratory is the "hood" or glass closet, connected with a ventilating-flue, in which is carried on all processes in which offensive gases are generated.

Among the most interesting objects would be the costly platinum dishes and crucibles, which are unaffected by nearly all chemicals, and withstand the most intense heat without melting. They have the appearance of ordinary tin; but formerly the price was from ten to twelve dollars an ounce, and the increased demand for platinum wire by the manufacturers of electric lights is rapidly appreciating it to an equality with gold. The measuring-flasks, which are graduated to hold exactly a liter of fluid, or some proportionate fraction; and the

Louis Pasteur.

burettes, or graduated glass tubes, from which any desired quantity of a liquid may be measured and drawn off with the greatest exactness, are also worthy of notice.

The chemist's balance is the most important and expensive piece of apparatus of which he makes use. A first-class balance costs over one hundred dollars, and a set of accurate weights about fifteen dollars. These balances are sensitive to $\frac{1}{20}$ of a milligram, or $\frac{1}{13000}$ of a grain. This is the weight of a fraction of a hair, or about the weight of the graphite used in writing one's name with a pencil. Ever since the time of Lavoisier, chemistry has been a science of relative *weights;* and its wonderful progress has been due, in no small measure, to the mechanical perfection to which the indispensable balance has been brought.

LOUIS PASTEUR.

We present, this month, a portrait of the celebrated scientist, Louis Pasteur, whose researches on the prevention of hydrophobia by inoculation have rendered him famous all over the world. Although he is most widely known in connection with this method, his discoveries in other directions have been of much more practical importance than the inoculation with the modified virus of rabies, the actual value of which is still uncertain. True, hydrophobia is such a rare disease, and presents so many varying aspects, that a long time must necessarily elapse before any plan of treatment can be said to be absolutely specific.

A committee, comprising some of the most distinguished English scientists and physicians, has recently published a report strongly affirming the efficacy of his method of preventing the development of this terrible disease. This indorsement from a tribunal so capable of judging of its value, and at the same time so unprejudiced and impartial, cannot but be most gratifying to M. Pasteur, as well as reassuring to the general public who may be in danger from the attacks of rabid animals.

One of his earliest investigations was upon a disease among silkworms, which threatened to destroy the silk-industry in France. He succeeded in bringing it under control, thus saving immense sums to the silk-growers of that country. His system of inoculations for the prevention of anthrax in cattle, has also proved a most efficient means of protection againt that fatal disease; and a process of preserving and improving wine and beer, by destroying the microbes by artificial heating, is extensively used in Europe, under the name of "Pasteurization."

The various species of microbes, bacteria, and ferments seem to be a favorite subject of study with M. Pasteur; and the importance which these organisms possess, both from a medical and technological point of view, render them a fitting subject for the researches of the highest scientific talent. We trust that M. Pasteur may be long spared to continue his work, which, we have no doubt, will be of even more value to mankind in the future than in the past.

[Specially reported for the *Popular Science News* from the Observatory of the College of New Jersey.]

ASTRONOMICAL PHENOMENA FOR SEPTEMBER, 1887.

The sun crosses the equator and autumn begins on Sept. 23, at 4 A.M., Washington time. Mercury is too near the sun to be seen, and passes superior conjunction on Sept. 10. Venus passes inferior conjunction with the sun, and becomes a morning star on Sept. 21. At the beginning of the month it is about an hour and a half east of the sun, but is at the same time about 17° to the south of that body, and consequently it sets very soon after sunset: at the end of the month it rises an hour before sunrise. Mars is a morning star gradually growing brighter. At the beginning of the month it will rise rather more than three hours before the sun, and at the end of the month about four hours before, or about 2 A.M. It is north of the sun 12° on Sept. 1, and 18° on Sept. 30. Jupiter is still an evening star, but is so far south that it sets only about two hours after the sun at the beginning of the month, and much earlier during twilight at the end. Saturn is a morning star two hours and a half west and 12° north of the sun on Sept. 1, and four hours west and 23° north on Sept. 30, on which date it will rise about 1

A.M. It will be found to have changed the position which it had in reference to Castor and Pollux during the past winter, being a considerable distance to the east (below), and distant from the nearer of the two stars about three times their distance apart. Uranus is rapidly approaching conjunction with the sun, and will be too near it to be seen during the month. Neptune is south and a little to the east of the Pleiades.

M.

[Specially reported for the *Popular Science News.*]

METEOROLOGY FOR JULY, 1887.

TEMPERATURE.

AVERAGE THERMOMETER.		Lowest.	Highest.	Range.
At 7 A.M.	71.29°	63°	78°	15°
At 2 P.M.	81.97°	70°	92°	22°
At 9 P.M.	71.13°	62°	79°	17°
Whole month	74.80°	62°	92°	30°
Second average	73.88°	62°	92°	30°
Last seventeen Julys	71.55°	68.96°, in 1884.	74.80°, in 1887.	5.84°
Second average	70.77°	68.25°	73 88°	5.63°

The present July has been the warmest — perhaps I should say the hottest — month of my entire record of twenty-four years. It has been 3.25° above the average of the last seventeen Julys in this locality, and 5.84° above the lowest during this period. The highest point reached at the hours of observation was 92° on the 2d; and this was the hottest day of the month, with an average of 81⅓°. From 10 A.M. till 5 P.M. the heat was intense, ranging 90° and above between 12 M. and 4 P.M. The lowest point during the day was 75° at 7 A.M. The following day averaged 80°, with extremes of 74° and 91°. The first day was nearly equal to this, with a mean of 79⅔; and these first three days gave the highest average, 80⅓°, of any three consecutive days on my record, with one exception in 1872, when the average reached 82⅓°. Single days have repeatedly exceeded the hottest of the past month, as July 1, 1872, with a mean of 83⅔°, July 15, 1873, at 82⅔°, etc. The first nine days of the month were also remarkable for continued heat, giving an average of 78.96°, while the last nine averaged 76.89°. The mercury reached 80° or above on 22 days at 2 P M. The 18th was the coolest day in the month at 67⅔°, and the lowest point was 62° on the 15th. In consequence of such continued excessive heat, there have been far more cases of sickness, sunstroke, and death than usual in July.

SKY.

The face of the sky in 93 observations gave 40 fair, 28 cloudy, 18 overcast, and 7 rainy, — a percentage of only 43 fair, the lowest in July for seventeen years. The average has been 62.6, with extremes of 43 in 1887, and 76.3 in 1878. It has been below 50 per cent only three times during this period. Has not this excess of cloudiness tended to increase the unusual sultry heat of the month, by checking a free radiation? "Dog-day" weather came early and remained.

RAIN.

The amount of rainfall the past month was 3.23 inches, well distributed. The average amount the last nineteen Julys has been 3.08 inches, with extremes of 1.43 in 1874, and 6.85 in 1876. The amount since Jan. 1 has been 31.07 inches, while the average has been only 27.46. A moderate thunder-shower occurred on the 29th, about 6 P.M., with only .18 inch of rainfall. Distant thunder was also noted between 5 and 6 P.M. on the 1st, but no rain in this locality.

PRESSURE.

The average barometer the last month was 29.976 inches, with extremes of 29.60 on the 10th, and 30.17 on the 5th, a range of .57 inch. The average pressure of July in fourteen years has been 29.919, with extremes of 29.820 in 1884, and 29.976 in 1887. March and July are the only months whose average in fourteen years has not reached 30 inches. The sum of the daily variations the past month was 2.46 inches, giving an average daily movement of only .079 inch. This average during fourteen Julys has been .090, with extremes of .074 and .118. The largest daily movements the last month were .24 and .21 on the 10th and 11th, in connection with rainfall. July and August exhibit the slightest barometric changes of any months in the year. These changes during the past month have been unusually small, even for July.

WINDS.

The direction of the wind in 93 observations gave 6 N., 2 S., 9 E., 21 W., 6 N.E., 8 N.W., 1 S.E., and 40 S.W., an excess of 23 southerly and 53 westerly over the northerly and easterly, indicating the prevailing direction to have been W. 23° 28′ S. The westerly winds in July for eighteen years have uniformly prevailed over the easterly, by an average of 41.44 observations, and the southerly over the northerly, by an average of 22 05, indicating the approximate average direction for July in eighteen years to be W. 28° 1′ S. The longitudinal extremes have been 11 and 59 W., a range of 48 observations, and the latitudinal 11 and 49 S., a range of 38. The relative progressive distance travelled by the winds the past month was 57.78 units, and during the last eighteen Julys 815 such units, an average of 46.94, showing less opposing winds the past month than usual in July. In other words, the winds were more south-westerly (and less north-easterly) than usual.

IN REVIEW.

It may be said that the last month was remarkable for its continued inteuse heat, its unusual cloudiness, high pressure, and numerous south-westerly winds. The extreme heat, especially, will be long remembered.

D. W.

NATICK, *Aug.* 5, 1887.

QUESTIONS AND ANSWERS.

LETTERS of inquiry should enclose a two-cent stamp, as well as the name and address of the writer, which will not be published.

QUESTIONS regarding the treatment of diseases cannot be answered in this column.

INQUIRER. — Is cotton-seed oil a perfectly healthful article of food?

Answer. — It is perfectly wholesome, and can hardly be distinguished from olive-oil, which it is extensively used to adulterate. Large quantities are exported to Italy, and returned to us as *huile vierge supreme de Lucca*. It can probably be obtained of any dealer in oils or wholesale druggist.

W. S., *Boston.* — I find that the references to certain plays in the article on "Shakespeare's Astronomy" do not agree with my edition of Shakespeare. How is this to be explained?

Answer. — The references and quotation given in the article referred to are according to Professor Rolfe's edition of the poet, and also to the standard "Globe" edition. Different editions number the various scenes somewhat differently, but the variations are usually unimportant.

H. C. S., *Boston.* — I have an alcohol thermometer in which part of the alcohol seems to have risen to the top of the tube, and remains lodged there. What is the cause?

Answer. — This is a common fault with such thermometers, and is caused by the vapor of the alcohol condensing in the upper part of the tube, which probably was cooler than the rest of the instrument. For this reason, alcohol thermometers are unsuitable for warm climates, and should be kept out of the direct rays of the sun.

L. M. P., *San Francisco.* — Which will lift the greatest weight, a balloon filled with hydrogen gas, or one of equal size in which there is a perfect vacuum?

Answer. — The ascensional force of a balloon is the difference between the total weight of the balloon and that of an equal bulk of air. All other things being equal, the balloon from which all the gas has been removed will weigh less than when filled with hydrogen, and consequently will ascend with a greater weight. The difference is about five pounds weight for every thousand cubic feet of bulk.

LITERARY NOTES.

Gilman's Historical Readers. By Arthur Gilman, M.A. The Interstate Publishing Company, Boston and Chicago.

The purpose of the three numbers of Gilman's Historical Readers is to present to the minds of the youngest readers, in schools and families, a simple and clear account of the growth of our nation, and of the events that preceded its birth on the continent of America. They are adapted for use, either as readers, or as first text-books in history, and are based upon the works of the latest and best historical students.

The series is graded from number one, *The Discovery and Exploration of America*, intended for the youngest pupils, to number two, *The Colonization of America*, and number three, *The Making of the American Nation*, which are suitable for older scholars. They are far superior to both the average "reader" or "history," and we can heartily recommend them in every respect. Prices 36, 48, and 60 cents respectively.

Electricity Treated Experimentally. By Linnæus Cumming, M.A. Published by D. Van Nostrand, New York.

The author of this work is assistant master of the famous Rugby School in England, and it comprises the substance of experimental lectures delivered to the senior class. The work is intended for use as a text-book; and special attention is paid to experimental illustrations of the principles of electricity and magnetism, while the latest theories and discoveries are clearly explained. Numerous engravings will aid both teacher and pupil in performing and understanding the experiments described.

The same firm also publish No. 94 of their "Science Series," *The Treatment of Sewage*, by Dr. C. Meymott Tidy. (Price 50 cents.) The problem of the disposal of sewage after it has passed out of the sewers or cesspools is no less important than its prompt removal from dwellings; and this little book gives full description of the various methods in use in the cities of Great Britain and Europe, with a discussion of their efficiency and economy.

The Fortunes of Words. By F. Garlanda. A. Lovell & Co., New York.

This popular treatise on philology is in the form of letters to a friend of the author, and gives a most interesting account of the derivation and formation of our language. Teachers and students of rhetoric or English literature will find it a valuable aid as a reference-book, or it can be studied by itself with much profit.

The Morphology of the Carinæ upon the Septa of Rugose Corals, by Miss Mary E. Holmes, A.M., was presented as a thesis for the degree of Doctor of Philosophy in the University of Michigan. It is a most valuable contribution to natural history, and gives evidence of a complete and thorough knowledge of the subject. Published by Bradlee Whidden, Boston.

The first number of the *American Journal of Psychology* is announced to appear in October. It will be edited by Professor G. Stanley Hall, Ph D., of Johns Hopkins University. It will be issued quarterly at $3 a year, and, we trust, will receive a hearty support from those interested in this important branch of science. The publisher is N. Murray, Johns Hopkins University, Baltimore, Md.

Pamphlets, etc., received: *On the Comparative Craniology of the North American Indians*, by R. W. Shufeldt, M.D.; *Recent Advances in Preventive Medicine*, by George H. Rohé, M.D.; *Twenty-second Annual Report of the Rutgers Scientific School*, New Brunswick, N.J.; *Eighth Annual Announcement of the Indiana Eclectic Medical College*; *Annual Announcement of Trinity Medical School*, Toronto, Canada; *Reports of the Agricultural Departments of Massachusetts and Georgia*; *Health Reports of Minnesota, Illinois, and Wisconsin*; and the *Quarterly Report of the Chief of the United States Bureau of Statistics*.

Medicine and Pharmacy.

[Original in *Popular Science News.*]

A WORD UPON TEA AND COFFEE.

BY MAURICE D. CLARKE, M.D.

Among the substances that, introduced into the animal economy, pass under the name of stimulants, is a group of vegetable derivatives, whose members are closely allied, and which includes coffee, tea, cocoa, guarana, maté, kola, and coca. Useful in moderation, they are capable of injurious effects in the excess which is not infrequently reached; though they fortunately lack the baleful energy of the more powerful stimulants, like alcohol and opium. Coca is the South-American plant from which the recently discovered alkaloid cocaine is obtained; and kola is an African product. They are used by the natives to support them under fatigue, and in the temporary absence of food. Maté is much the same as our common tea, which happens to grow in Paraguay instead of China. Guarana is a Brazilian product, with an excess of the alkaloid that is common to most of the class, and is chiefly used by us for relief of nervous headache, with the usual variable success. With none of these has this paper any especial concern: they are kindred to themselves and to the remainder of the group, though they may have wide differences, — as coca, e.g., contains a remarkable alkaloid, foreign to the rest, — but their properties are not yet known with precision.

All of this class, with the possible exception of kola and coca, contain a similar active principle, or alkaloid, which goes under the name of caffeine in coffee, theine in tea, and theobromine in cocoa (*Cacao theobroma*). Of the three, cocoa differs from the other two in containing more nitrogenous matter, and much more fat, and is, therefore, *cæteris paribus*, much more nutritious. So that as a food, pure and simple, it ranks the highest of the three; while it has nothing of the peculiar sustaining power of the coca-leaf (presumably different in kind), or of the anæsthetic virtues of its alkaloid, cocaine. The cocoa of commerce is the ground and pressed nuts, or seeds, of the cacao-tree; mixed with sugar (and often with cheap adulterants), and flavored with vanilla, it becomes chocolate; broken into pieces, the nuts are called cocoa-nibs; deprived of its oil (cocoa-butter), it is known as broma; while the pods that contain the nuts, and which have a suggestion of the properties of the latter, are cocoa-shells. As a mild stimulant and an excellent food, cocoa is valuable; though there are people to whom its nutritious fat is repugnant. It is probably the only one of the group that is not indulged in to excess.

Coffee we all know as a decoction of the ground and roasted coffee-berry of Java, Brazil, and elsewhere. It contains several things of little moment, some tannin, (the substance in bark that converts hides into leather), and an alkaloid, caffeine. There is also developed in the roasting, if roasted not too much or too little, a volatile oil, caffeone. The main effects of coffee are due to both the caffeine and the caffeone, which are antagonistic, though not contemporaneous, in action. The volatile oil, in technical language, reduces arterial tension, allows a brisker flow of blood, and so increases the rapidity of the heart's action. It also acts upon the brain, and intellectual faculties in general; keeps one awake, and his mind clear. Caffeine, on the other hand, — like digitalis, — produces a high arterial tension, and slows the heart. It exerts its chief effect upon the spinal cord, to which it is an excitant, like strychnia. The shaking hand of the inveterate coffee-drinker is caused by caffeine. So that a cup of coffee produces on the drinker a double effect, — of the oil and the alkaloid; the former sooner and more transient, the latter later and more lasting. It is well understood that the human body is a machine, kept in motion, like other machines, by processes of combustion. Among the combustion products are substances known as urea and uric acid, which represent the ashes of nitrogenous food; and the production of both of these is retarded by coffee. But, under ordinary circumstances, more or less nitrogenous matter is needlessly burned up; and this waste, therefore, is hindered by coffee. It is not in itself nutritious to any marked degree; but it saves food, and also maintains life, by its exhilarating effect upon the nervous system. It is an excellent antidote to opium, producing the wakefulness that antagonizes the narcotic sleep of the drug; is now and then curative of sick headache, and is one of the standard remedies for certain forms of nausea. It is, however, on account of its mild exhilaration, and its indirect nutritive value, that it is found on so many breakfast-tables, and forms one of the staples of the supplies of military and naval quartermasters. And it was these qualities that brought to the United States, in 1886, five hundred million pounds.

Tea, as we use it, should be an infusion, but is too often a decoction, of the tea-leaf of China and Japan. To the chemist, it is much the same thing as coffee. It contains considerably more tannin, a volatile oil, and an alkaloid (theine) indistinguishable from caffeine. Its difference from coffee, outside of the greater astringency its tannin gives it, is very likely due to subtle qualities that defy the chemist's retort and beaker. Having many of the same characteristics, however, it is used for much the same purposes. It, so to speak, quickens the vital functions, and seems to be an especial excitant to respiration. It is believed to be, unlike coffee, a promoter of assimilation of food, and therefore is ineligible to the place that coffee occupies in so many dietaries. That the injurious effects of overdoses are due as much to the volatile oil as to the alkaloid, is shown by the fact that tea-packers are made ill by long breathing of air filled with it, and that tea-tasters in China, who avoid swallowing the infusion, can endure their trade but a few years, and leave the country with shattered nerves.

Tea and coffee, like other stimulants, offer, as is remarked above, the opportunity for abuse, — an opportunity quite often availed of. Their devotees drink, for the mere love of them, more than they ought; the scholar deprives himself of needed sleep by their use; the daily toiler finds a temporary surcease of sorrow in the frequent cup. While there are undoubtedly many who overindulge in coffee, they are probably few in comparison with the victims of the tea-habit. It is an every-day experience in the out-patient departments of the large hospitals, for sufferers to apply for the relief of symptoms reasonably attributable to the abuse of tea. It is the same old story with the washerwoman, the kitchen-girl, or the poor mother of a large family, — a lack of appetite, a distress after eating, a series of headaches, occasional attacks of dizziness. "I has no mind for the vittles, and I has the pain in me stomach, and so I just takes a sup of tea now and then." There is no day in the year when at every dispensary and out-patient room in the large cities some woman (for this is essentially a feminine dissipation) does not present herself with a statement of this sort. The victim's account is an "o'er true tale." Either from excess of tea, or for some other reason, she loses her appetite, and gradually comes to loathe food. In this extremity she seeks solace in the cup, and thus increases the condition she is already bewailing. When this sort of thing has reached a certain point, she applies for medical aid, and, it is needless to say, usually scorns the suggestion to go without tea. It has been suggested that the dyspepsia in these cases attributed to tea may rather be due to insufficient food. It is very doubtful, however, if, in the cases referred to, the food is insufficient. No doubt, there are those who suffer from lack of suitable food, and who, if they use tea, lose more than they gain by it; but such are not found among the tea-drinkers of the hospitals, except as they wilfully forsake good food for tea. It is to be borne in mind that the people of whom these are representative, get from tea all the harm there is in it, since, in one of the slang phrases of the day, they "work it for all it is worth." Not only do they get all the theine and most of the volatile oil, but their method of preparing it extracts all the tannin possible. The Chinese, who are the ideal tea-drinkers, pour boiling water on the leaves at the very moment of use; but it is the practice of the poorer classes to keep a "pot of tea" steeping on the stove all day long, to be drunk from at intervals. It is probable that much of the dyspepsia and constipation to which this class of tea-drunkards is subject, is due to this continual use of an astringent decoction.

It is not to be inferred, however, that the abuse of tea is confined to the poorer classes. It is true that its relative cheapness invites them more especially to this form of indulgence. But it is within the experience of every physician to be often called upon to treat patients suffering from the evils already described, who lack the excuse of poor food and a hard life to plead for over-indulgence. Probably every one numbers among his friends women who are actual slaves of the tea-habit, and who would find tea as hard to forsake as men find tobacco. It is not unlikely that the functional cardiac disorder, often spoken of as the "tobacco heart," due to nervous derangement, and accompanied by palpitation and pain in the cardiac region, is more often due to tea than tobacco. In fact, the disorders induced by excessive tea-drinking have been grasped as a special disease, to which has been given the name of theism, from *thé* (tea). This includes a train of symptoms, usually progressive, many of which have been already referred to, — loss of appetite, pain after meals, headache, constipation, palpitation, cardiac distress, hysterical manifestations, dizziness, paresis. Whether we are justified in thus setting off these symptoms as a disease, is open to doubt; but the fact that it has been done, emphasizes the importance of tea, in comparison with the rest of the group, in reference to the mischief that will follow the abuse of it. It is needless to say that the main factor in the treatment of this condition is abstinence from the plant that causes it.

MONTHLY SUMMARY OF MEDICAL PROGRESS.

COMPILED EXPRESSLY FOR THE POPULAR SCIENCE NEWS.

BY W. S. WELLS, M.D.

For the purpose of wiping out the larynx, in cases of croup, Dr. M. Hartwig of Buffalo introduces a silver catheter with open end, and containing a guide to which is fastened a piece of sponge. After the catheter is in the rima glottidis, the sponge is pushed out by the guide, and then withdrawn together with the instrument. The sponge, previously compressed in the catheter, would expand, and sweep away the membrane during its withdrawal. The manipulation should be rapid, so as to avoid protracted interruption of breathing. The principal objection would seem to be

the liability of crowding the membrane down the trachea.

This method will not prevent subsequent intubation, should it seem necessary; and remedial agents may be thus applied.

It is stated, that, after the first formation of membrane has been removed, that which is formed again is less firmly adherent.

M. DEJEAN states that hæmoptysis is not always a symptom of incipient pulmonary phthisis, as is generally supposed, but may be due to dilatation of the bronchi, from a varicose condition of the capillaries, or miliary aneurisms of the bronchial mucous membrane. An important feature of this form of hæmoptysis is that the blood which is brought up is rarely frothy, as it is in the case of tubercular disease, in which latter there are also bacilli.

ALTHOUGH the final results of surgical operations to relieve pathological conditions of the spinal cord, have not been very encouraging, the operation lately reported from London, by Mr. Victor Horsley, promises success.

The diagnosis of compression of the spinal cord by a morbid growth was made by Dr. Gowers, who saw the patient, — a man, aged forty, — who had suffered for four years from pain round the chest, supplemented by paraplegia. From the history of severe neuralgic pain in the back and along the course of the left sixth dorsal nerve, which preceded the paraplegia, it was considered probable that the growth commenced in the posterior root of the nerve, and afterward produced pressure on the cord. The operation was performed by a long incision in the mid-line of the back, having its centre about the fifth dorsal, down to the spines of the vertebræ. The muscles were cleared off from the laminæ, and retracted. The spines were removed by bone-forceps, and the laminæ trephined. An incision was made through the membranes; and the cord being examined, a tumor about the size of the tip of the little finger was found on the posterior root of the nerve, about the level of the third dorsal vertebra.

This had pressed the cord forward and to the right, producing a deep depression in its substance.

It was removed, with the nerve to which it was attached. The incision through the membrane, which was at least three inches long, was not sutured; but the wound in the outer soft parts was closed with suture, and drained. Strict antiseptic precautions were taken at the operation. The painful spasmodic action of the lower extremities, from which the patient suffered, has diminished, and there has been less rigidity of the legs; but the paraplegia continues, at last accounts.

IN a paper read before the British Medical Association, at Brighton, Mr. Snell redirected attention to friction, or "massage," as a mode of hastening the disappearance of corneal opacities, so liable to follow inflammations. The following is probably the best mode of employing "massage." The inner surface of the eyelid should be lubricated, preferably with Pagenstecher's ointment; the pulp of the finger is then laid on the lid, and the latter moved to and fro over the cornea with great rapidity, in a direction radiating from the centre of the cornea. The operation is continued for about a minute, and repeated daily, as long as improvement continues to follow; and the results of cases reported, encourage perseverance in the treatment for a considerable time.

DR. W. J. LAWRIE, of Ayr, Scotland, refers to a recent case of death by burning, in Edinburgh, and draws attention to the treatment of such and similar injuries by Hebra's water-bed. This so-called water-bed is simply a specially constructed bath, in which the injured part is submerged. Not only cases of burns and scalds may be advantageously treated in this way, but all diseases associated with loss of epidermis, and consequent severe pain, are included, especially extensive sloughing ulcers, erysipelas, pemphigus foliaceus, and abscesses. The wounded surfaces are kept in the bath, and are thus continuously out of contact with the air; and as they are not covered with any form of dressing, the discharges escape at once into the water, and the wounds are kept clean. There is scarcely any limit to the time patients may remain in the bath: in more than one case, they have been continuously submerged for three hundred and eighty-five days and nights, only leaving the water for functional purposes. Plain water alone quiets all local pain; but the water may be medicated with antiseptics, anodynes, etc., to meet special conditions.

M. TERRIER communicated to the Paris Surgical Society lately, his new method of performing trans-peritoneal nephrectomy. The abdomen is opened in the middle line, and the intestine pushed aside, so as to uncover the peritoneal membrane covering the kidney. A vertical incision is then made in the membrane, the edges of which are held back with clamps. After removal of the tumor, the pedicle and the ureter are tied and brought forward through the peritoneal incision, to the abdominal wound, where they are secured. In this manner the peritoneal cavity is closed on all sides. M. Terrier claims that this method obviates the necessity of drainage through the loin.

FAVORABLE reports are given by Gomperz of Vienna, regarding the use of antipyrin in seven cases of uncomplicated nervous otalgia. He gave from fifteen to twenty-five grains per dose. One of the cases was double, had persisted more than a month, and was cured by fifteen grains of antipyrin. Another took thirty grains. All were improved.

A Paris correspondent writes that recently M. Germain See read a paper before the Academy of Medicine, on the use of antipyrin as a substitute for morphine. He gave it hypodermically, and claims that it allays pain without producing somnolence, or the exaltation of the nervous system sought by those who indulge in morphine for this species of intoxication.

SEVERAL cases of septicæmia are reported, in which post-partum hemorrhage had been successfully stopped by the introduction of pieces of ice into the uterus. This sequence, taken in conjunction with the recent researches of Dr. Prudden, as to the presence of living bacteria in ice, is thought to point to direct septic infection from the ice placed in utero, and should discourage its use where hot water can be used as a hæmostatic agent.

BEFORE operating upon the brain, Mr. Victor Horsley, the English surgeon, administers morphine, and exercises great care in the subsequent anæsthesia by chloroform, as dangerously deep narcosis may easily be induced. The object in giving morphine, it is stated, is to produce contraction of the cerebral arterioles, in order to diminish hemorrhage. Special care is taken to fashion the scalp-flap — for the old crucial incision is abandoned — so as to preserve either the temporal or the occipital arteries, and the periosteum is reflected along with the cutaneous structures. The bone is first of all attacked with the trephine, and the aperture in it is enlarged with a circular-saw, driven by a surgical (dental) engine. After excising the tumor, cyst, or cicatrix, the flap is replaced, and completely sewn up, except for one inch at the most dependent part, where excess of fluid can drain away. No drainage-tube is used; and strict Listerism is observed for the first four or five days, or until the wound is healed. Mr. Horsley says he is more than ever convinced that the arachnoid, like the peritoneal cavity, may be trusted to absorb excess of fluid.

VERNEUIL (*Gazette-Herald*) treats certain cases of obstinate nose-bleed with active counter-irritation over the hepatic region. The patients upon whom he practised this method were adult males, with irregular intermittent epistaxis, — not severe, nor preceded by malarial symptoms, but uninfluenced by hæmostatic remedies. On examination, the liver was in two cases found diminished in size, in one enlarged. In these three cases, M. Verneuil applied a large blister over the hepatic space, with the result of checking the hemorrhage from the nose promptly. M. Verneuil gets his authority for this procedure from quite a respectable old practitioner, known in his day as Galen.

DR. MARTI (*British Medical Journal*) has had excellent results from the internal administration of cocaine (fifteen centigrams in a hundred and fifty grams of water, a dessert-spoonful every half-hour) in three cases of excessive vomiting of pregnancy.

THE following is the recipe for the antiseptic fluid used in the preparation of gauze for the Austrian army: Hydrg. bichlor., 1 part; spirit vini, 100 parts; aquæ dist., 125 parts; glycerini, 50 parts; fuchsin, $\frac{1}{100}$ part. The coloring-matter is to render the material easy of recognition.

M. LUCAS-CHAMPONNIÈRE uses the following antiseptic powder: Recipe, — Iodoform, quinia, benzoin, carbonate of magnesia (saturated with essence of eucalyptus), equal parts. Sift separately and mix. This is applied directly upon the wound, or over a protective, and dressed with the usual layers of gauze. In large operations, this dressing is changed in three days: in minor ones, it is left on for a week.

[Original in *Popular Science News*.]

METASTATIC INFLAMMATION OF THE BRAIN CURED BY SIMPLE REMEDIES.

BY DR. S. F. LANDREY.

A FARMER'S two-years' old child was almost dying. Unconscious, eyes upturned, cold, and deathly pale, — having, to all appearances, passed the last stage of recovery from metastatic inflammation of the brain produced by a violent attack of cholera-infantum. The old, experienced family physician had given it up to die. I did not feel much flattered by being sent for at the "eleventh hour," but determined to save the child's life if possible.

Some common thistle-roots (*Cirsium lanceolatum*) were dug, well washed, and finely chopped; these, with about an equal bulk of hops, were put into a common dinner-pot, and boiled in about four times as much water, to one-half; strained, and thickened with wheat-bran and shorts mixed. Three "sacs" about six inches square were made and filled, so as to make poultices over an inch thick. The proper heat was ascertained by the mother's cheek, — what she could bear easily; and one of the "sacs" was placed under the child's head. It was not permitted to grow cold till another one took its place. In one half-hour it revived a little. In two hours after the third poultice had been used, the child was given some nourishment. It made a good recovery. In an almost precisely similar case two years before this, I had used two ounces of sulphuric ether (pure) poured carefully over the parts

of the head covered by hair; keeping it out of the ears and eyes, with raw cotton in the former, and a compress carefully held over the latter. A linen handkerchief was placed over the head, closely pressed to it. The child revived at once. The handkerchief prevented too rapid evaporation of the ether, and effectually reddened the scalp by inviting the blood to the surface. Thus by counter-irritation, — effected in two different ways, — by an excellent nerve-sedative, and an arterial stimulant, were two babes restored to life and health. An hour later, probably both remedies would have failed in each case, and otherwise good medicines might have been condemned, and placed in the secondary list. To use the *proper* remedy in the *best* way and at the *right* time are the only medical secrets to be learned.

INFLUENCE OF ALTITUDE ON PHTHISIS.

In a recent number of the *London Lancet*, Dr. Nathaniel Alcock proposes the following most ingenious theory to account for the beneficial effects of a residence at a high altitude upon consumptive patients. Although we are hardly prepared to accept it as entirely correct, it is founded upon well-known principles of physics, and is worthy of notice:

"The explanations hitherto offered of the action of altitude upon phthisis amount to three, — greater expansion of the chest from aerial rarefaction, absence of bacterial organisms from the air, and general tonic effect. Were the first of these effective, some improvement would be expected to follow the use of gymnastics at lower levels; of the second it may be said that every consumptive carries his own microbes with him; and the third is too vague to need discussion. It may therefore be assumed that no satisfactory explanation has as yet been suggested. The specific organism of tubercle has an established identity: consequently the disease must be ranked among the special infections, and its aggravation or arrest must depend upon the fertility or sterility of the microbe to which it is due.

"Pasteur has shown that 'splenic fever can never be taken by fowls; in vain are they inoculated with a considerable quantity of splenic blood.' 'Now, the temperature of birds being between 106° and 108°, may it not be,' said Pasteur, 'that the fowls are protected from the disease because their blood is too warm? A hen was taken, and, after inoculating it with splenic-fever blood, it was cooled down to 100°. At the end of twenty-four hours the hen was dead. Again, a hen was inoculated, subjected like the first to cooling, and, when the fever was at its height, it was wrapped in cotton-wool, and placed in an oven at 95°. In a few hours it was fully restored to health. Hens killed after having been thus saved, no longer showed the slightest trace of splenic organisms.' Thus it is proved that the microbe of one of the most virulent diseases reaches its condition of highest life and greatest reproduction in blood at a temperature of about 100°, but that in the same blood at 107° it ceases to exist. Presumably, then, if the subjects of some forms of bacterial infection could survive a proportionate elevation of temperature, they, too, would overcome the poison.

"The question here arises, Are there any conditions in which the blood of a living man can be made to assume the molecular action equivalent to a temperature of 105° while the animal heat remains at 98°? Clearly such is quite possible by diminishing atmospheric pressure while the temperature remains fixed. We know that it would be quite impossible to boil water at the sea-level with 199° of heat; but if the water be removed to St. Gothard, 6,808 feet high, boiling will at once take place. Consequently, if 199° of heat can make water boil at St. Gothard, it is apparent that this temperature can there produce an amount of molecular motion which not less than 212° could excite at the sea-level. Further, as 199° is to 212°, so is 98.4° to 104 8°; therefore the rate of molecular motion to which a temperature of 98.4° would give rise at St. Gothard, could only be attained at the sea-level as the result of a temperature of 104 8°. Consequently, if a man whose temperature at the sea-level is 98.4° be removed to St. Gothard, it is evident that both the gaseous and liquid molecules in his blood must attain a rate of motion corresponding to what would have been produced at sea-level by a temperature of 104.8°. Hence, it is intelligible that, if a consumptive patient, whose temperature at sea-level is 98 4°, be raised to an elevation of 6,000 feet, such alteration of molecular motion will take place in the blood as to be incompatible with the healthy existence and effective reproduction of the tubercular microbe: in fact, the patient will be placed in the position of the bird to the splenic-fever poison. If this reasoning be sound, wide is the vista with regard to the epidemic levels of yellow-fever, malaria, cholera, etc , which it must open up, and strange the possibilities which might result from the artificial production of the required conditions."

THE SKELETON INDUSTRY IN FRANCE.

A correspondent of the *Medical Press* of London communicates to that journal the following account of a skeleton manufactory which he recently had an opportunity of visiting.

The large hall contains two rows of immense kettles, the emanations from which are, as might be supposed, far from agreeable, even to an olfactory apparatus used to the atmosphere of a dissecting-room. These kettles serve for ridding the bones of their adhering tendons, through boiling. The disarticulation of the skulls, which is performed separately, constitutes the most delicate part of the operation. In the case of children or young adults, it is effected through an ingenious process consistiug in filling the cerebral cavity with dry peas, and then immersing the skull in water. Through the effect of such immersion, the peas swell, and bring about a dislocation of the most delicate sutures.

After the bones have been submitted to a prolonged boiling, they are carried to tables, where young women carefully scrape them, in order to free them perfectly from the soft tissues that adhere to them. Certain specialists obtain very high wages for this work.

After being scraped, the bones are bleached, either through the action of chloride of lime, for cheap skeletons, or that of the sun for high-priced ones. Finally, they go to a special workroom, where they are assembled, mounted upon brass, and articulated.

These final operations require a profound knowledge of osteology, along with an artistic eye. In fact, it is necessary to select, from a collection of all sorts of bones, those that can be well enough assembled to look as if they came from one and the same individual. The others are sold singly, for the use of students of limited means, who are content with a portion of an unmounted skeleton. It is curious to find that sex has a great influence on the market value of the bones, a beautiful female skeleton being usually worth twenty or twenty-five per ceut more than a male oue of corresponding quality.

It may naturally be asked whence all the cadavers come. Most of them, it appears, are furnished by the hospitals and dissecting-rooms, and others by the prisons. As a general thing the supply has been less than the demand; but in recent times, the abundance and cheapness of skeletons of Austrian origin have considerably depressed the market. Nevertheless, despite the industrial and commercial crisis that prevails throughout the world, the industry under consideration seems to be in a most flourishing condition.

THE TEMPERATURE OF THE SKIN.

The experiments of Davy long ago demonstrated irrefutably that the temperature of the interior of the body varied little in man with race, climate, or season; yet it is familiar to all that the temperature of the skin varies considerably in different parts — the extremities, for example; and those parts of the skin in which the circulation is feeble being cooler than other parts. Quite recently some interesting experiments to determine these variations of the surface have been made by Professor Kunkel at Wurzburg. Taking the skin of the face in the first instance, he finds that in men from twenty to thirty years of age it varies from 85° to 89° F., with an approximate average of 88°. The skin of the more exposed parts of the body, as the tip of the nose and the lobules of the ear, in which the circulation is slow and feeble, exhibited a lower temperature, not exceeding in many instances 75°, or even descending as low as 71 5°. The skin covering the muscular portion of the body is warmer than that over the bones and tendons. Contraction of the muscles caused the temperature of the superjacent portion of skin to rise one degree or more. The decrease of temperature from the skin to the outer covering in a room at a temperature of 63° was as follows: on the skin 88°, on the linen shirt 82°, on the vest 75°, and on the coat 72°. The highest temperature was found to occur in men in the full vigor of life. As a singular fact, Dr. Kunkel states that children otherwise in perfect health showed a much lower degree of surface temperature — from 77° to 84° — than adults. He does not appear to have followed out Professor Lombard's observations on the temperature of the head. — *Lancet.*

LEECHES OF JAPAN.

A recent account of the leeches of Japan, by Dr. C. O. Whitman, is illustrated by colored drawings by Mr. Nomura, a young Japauese artist. The Japanese land-leech is among others the most interesting from its habits. It is confined to the mountain slopes aud ravines, never descending into the plains. It is not only a mountaiu-leech, but it keeps habitually to the ground, living in moss, or under damp leaves and rubbish. They are most voracious, and on the approach of man or beast are at once ou the alert. They advance by rapid strides. They bite so gently as scarcely to attract attention; but the wound is deep, and the scar is more or less permanent. They gorge themselves for about thirty to forty minutes, and then drop; while sucking, they become bedewed with a transparent liquid, which keeps them moist. If placed in water, they do not swim, but sink, and then creep out, and, while having a decided preference for a terrestrial life, can support life for days in water. If into a jar of hungry leeches, a puff of breath is blown, they become much excited, and it will be difficult to keep them in: while trying to keep back one, a dozen others will get out. The geographical area of land-leeches is mainly within the tropics, though in Japan they are exposed to a wide range of temperature. A new medicinal leech was discovered, well known to the Japanese, and with habits just like the European leech. In these leeches the segmental organs are shown to be sense-

organs; and the author believes that from them the eyes have developed, so that he regards them as incipient eye-spots. — *Naturalist's Bulletin.*

TOILET POWDERS.

THE following recipes, from the *Druggists' Circular*, can be easily prepared by any druggist, and contain no poisonous ingredients: —

NURSERY POWDER.

(To cure severe chafing.)

Gum camphor	¼ ounce.
Carbolic acid	15 drops.
Oxide of zinc	⅜ ounce.
English precipitated chalk	2 ounces.
Oil of neroli	5 drops.
Oil of rose	2 "

Rub the camphor to a fine powder in a mortar, using alcohol to reduce it, and mix the other components thoroughly.

This powder is invaluable for healing raw and irritated surfaces, and for curing sunburn. Mixed in the proportion of three parts of vaseline or cold cream, it forms one of the most useful domestic remedies, in the way of a general healing salve, that can be suggested. Far less useful remedies have enjoyed immensely large sales.

PERFUMED TALC.

Finely powdered talc	1 pound.
Extract of jasmine	¾ ounce.
Extract of musk	¼ "
Oil of rose	8 drops.

VIOLET TALC.

Finely powdered talc	14 ounces.
Finely powdered orris-root	2 "
Extract of cassia	½ ounce.
Extract of jasmine	¼ "
Extract of musk	1 dram.

ROSE TALC.

Finely powdered talc	14 pounds.
Oil of rose	10 drops.
Extract of jasmine	½ ounce.

CARBOLATED TALC.

Finely powdered talc	1 pound.
Pure carbolic acid	¼ ounce.

BARBER'S TOILET POWDER.

(To be used after shaving.)

Corn-starch	5 pounds.
Precipitated chalk	3 "
Powdered talc	2 "
Oil of neroli	1 dram.
Oil of citron	1 "
Oil of orange	2 drams.
Extract of jasmine	1 ounce.

POUDRE DE RIZ,

A la Violette.

Corn-starch	7 pounds.
Rice-flour	1 pound.
Powdered talc	1 "
Powdered orris	1 "
Extract of cassia	3 ounces.
Extract of jasmine	1 ounce.

A cheaper grade of this powder, for general trade, is thus made: —

Potato-starch	8 pounds.
Powdered talc	1 pound.
Powdered orris	1 "
Extract of cassia	3 ounces.

POUDRE DE RIZ,

A la Rose.

Corn-starch	9 pounds.
Powdered talc	1 pound.
Oil of rose	80 drops.
Extract of musk	2 drams.
Extract of jasmine	6 "

A cheaper grade of this powder for general trade, can thus be made: —

Potato-starch	9 pounds.
Powdered talc	1 pound.
Oil of rose	45 drops.
Extract of jasmine	½ ounce.

Invisible powders take their name from the supposition that they beautify the complexion without advertising their use by their visible presence. The term, unfortunately, is a misnomer; but popular use of the phrase possibly justifies its service as a means of expression; so we will offer a formula for invisible powder.

Carbonate of magnesium	½ pound.
Pulverized talc	1 "
Oil of rose	8 drops.
Oil of neroli	20 "
Extract of jasmine	½ ounce.
Extract of musk	1 dram.

Precipitated chalk can be added if desired, to have the powder heavier.

Both of these can be easily transformed into "flesh" tint by addition of finely powdered carmine. All the above should be passed through a 100-mesh bolting-cloth after mixing.

HUMORS.

EVEN a doctor who speaks only one language, may yet understand a great many tongues.

A FAMILY in a Michigan town is said by a newspaper to be passing through the waters of affliction, twelve members of the family being sick with typhoid-fever. It is evident that the waters of affliction are furnished by the well.

"JUBILEE" DISSIPATION. — An English clergyman writes to the *Agricultural Gazette* the following account of a terrible spree indulged in by him during the recent festivities. "I am not good enough for any thing to-day but to write nonsense illegibly; for all the virtue is gone out of me by reason of yesterday's excesses at the Jubilee, at which I drank six cups of tea, and ten glasses of hot lemonade, between noon and ten P.M., without any time for solid food." One hardly knows whether to sympathize with the probable condition of his stomach, or the obvious weakness of his head.

AN "UNOFFICINAL" DRUG. — A St. Louis drug-clerk, having obtained a prescription calling for "Blatta Orientalis, 2 grains," was compelled to "hustle" for the blatta for several hours among the classic precincts of that city without success. Finally, by prosecuting his search for the "bird" in its native lair, — a Chinese laundry, — no difficulty was experienced in securing an ample supply. As the cockroach is a sheet anchor of the Chinese materia medica, the Celestials, no doubt, thought it quite natural that they should supply the drug.

AN URGENT CALL. — A French practitioner received a call one afternoon, about five o'clock, from one of his country patients, a farmer who had been in town at market all day, who requested him to drive over at once to see a member of his family. The case not appearing to be urgent, the doctor replied he would go in the morning. "Oh, that will not do at all," said the farmer. "I ask you to go now because I want a lift home, and to hire a trap will cost more than your visit."

"GOOD-MORNING, children," said a physician, as he met three or four children on their way to school. "How do you do this morning?"

"We daren't tell you," replied the oldest of the crowd, a boy of eight.

"Dare not tell me!" exclaimed the doctor; "and why not?"

"'Cause papa says that it cost him fifty dollars last year to have you come in and ask how we were."

The Popular Science News.

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POPULAR SCIENCE NEWS COMPANY,

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ONE DOLLAR A YEAR, IN ADVANCE.

SETH C. BASSETT,
MANAGER.

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Publishers' Column.

PAIN is frequently needless; for instance, the pain produced by a bad pen, when the remedy is easy. Get one of Esterbrook's. All stationers have them.

IMPERIAL GRANUM is one of the oldest of the numerous artificial foods, and also one of the best. Its sales are rapidly increasing.

D. C. HEATH & Co. advertise in this number a number of standard scientific text-books which are well worth the notice of school teachers and committees.

THE advertisement of the F. J. KALDENBERG Co. on page 6 should be read by all mineralogists and curiosity collectors.

THE LACTATED FOOD, manufactured by the WELLS-RICHARDSON COMPANY, has several points of superiority over other similar preparations, which are fully set forth in the advertisement.

ATTENTION is called to the advertisement of THAYER'S NUTRITIVE FOOD, which is especially suited to debilitated conditions of the system, and in convalescence from acute diseases. It combines some valuable medicinal tonics with the nutritive qualities of beef extract.

PERSONS intending to place heating apparatus in their houses the present autumn, are invited to address MESSRS. LEBOSQUET BROTHERS for circulars. They still manufacture Dr. Nichols's WROUGHT-IRON FURNACE, the best in the market, as well as a LOW-PRESSURE STEAM-HEATING APPARATUS.

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CHAMPION ICE FACTORY,
COVINGTON, KY., Sept. 3, 1885.

Mr. David Boyle, Chicago, Ill.

Dear Sir, — The 50-ton ice-machine erected by you for us last spring has proved itself to be a "daisy;" it turns out from 35 to 37 tons of ice daily, and has done so all through the hot weather; the fact is, you can just feel it making ice. We make with it 37 tons at a *less* cost than the machines we took out, made 15 tons. It saves us at least 33 per cent over the other machines in making ice. The first 15-ton "Boyle" was a tip-top machine, but your new improved discounts it all the time: it saved us from everlasting bankruptcy this season, as we were compelled to sell ice for $3 per ton. Respectfully,

R. W. DUGAN, *Superintendent.*

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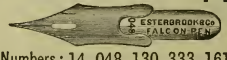

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The Popular Science News

AND

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CONTENTS.

FAMILIAR SCIENCE. — Antoine Laurent Lavoisier 141
Oriental Railroads 141
The American Association at New York 142
Paris Letter 143
Notes on the Oaar 144
Benefits of the Moon 144
Scientific Brevities 144

PRACTICAL CHEMISTRY AND THE ARTS. — What Chemistry has done for the Arts 145
An Amusing Application of Photography 145
A Peculiar Property of Tin 146
A New Heat-Measurer 146
A Cheap Gas-Holder 146
Industrial Memoranda 146

HOME, FARM, AND GARDEN. — The Mysteries of Plant-Growth 147
Poisonous Wild-Plants 148
Butter and Oleomargarine 148
Gleanings 148

EDITORIAL. — A New Basis for Chemistry 149
A Magic Mirror 150
Astronomical Phenomena for October, 1887 150
Meteorology for August, 1887, with Review of the Past Summer 151
Questions and Answers 151
Literary Notes 151

MEDICINE AND PHARMACY. — A New Cause of Death by Drowning 152
The Ninth International Medical Congress 153
Monthly Summary of Medical Progress 154

PUBLISHERS' COLUMN 154

Familiar Science.

ANTOINE LAURENT LAVOISIER.

THE interesting description of the trial and execution of this eminent chemist given by our Paris correspondent in the last number of the *Science News*, leads us to give a short account of his life and the important work which he accomplished in the establishment of a rational theory of chemistry.

Lavoisier was born at Paris in August, 1743. He was of a noble and wealthy family, and received a thorough education. His taste for science was early developed, and at the age of twenty-three he received a prize from the Academy of Sciences for his investigations upon the best method of lighting the streets of cities. In 1776 he was at the head of the "Saltpetre Commission," which had charge of the manufacture of gunpowder for the kingdom, and introduced improvements which made the French powder a third stronger than before. He also held several important political offices; and in 1769, in order to obtain sufficient revenue to carry on his experiments, he obtained the position of *fermier-générale*, which led to his judicial murder twenty-five years later. In 1771 he was married to a Mlle. Paulze, but left no descendants.

The work for which Lavoisier will always be remembered was the discovery of the true nature of combustion, and the final disproving of the phlogiston theory, which had been accepted for nearly a hundred years. Briefly stated, this theory held that all combustible bodies contained a substance called phlogiston. When this body escaped from its combination, combustion ensued. Thus, lead was supposed to be a compound of minium (oxide of lead) and phlogiston; when burnt or calcined the phlogiston escaped, leaving the minium, or true base, behind. Although it had been noticed that the calcined bodies weighed more than the original phlogiston compound, little attention had been paid to it, and it was explained by the supposition that phlogiston was a body of "negative gravity," or specific lightness, which reduced the weight of substances with which it was combined. Although the idea of matter without weight seems almost incomprehensible in these days, a similar concept has been suggested within a year by a scientist of wide reputation.

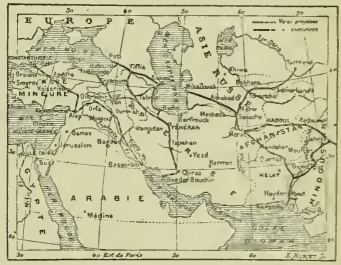
It was this theory that Lavoisier finally overthrew. He introduced for the first time the systematic use of the balance into chemical research, where formerly only changes of volume or appearance were considered. He observed the constant and definite increase of weight in bodies submitted to calcination or combustion; and when, in 1774, Priestley announced the discovery of oxygen gas, the whole problem became clear to him, and combustion was shown to be a process of addition of oxygen, and not of subtraction of phlogiston. The principle formulated by him, that "every chemical change consists in a transferrence, or an exchange, of a portion of the material constituents of two or more bodies, while the sum of the weights of the substances undergoing chemical change always remains constant," must be considered as the corner-stone of chemical philosophy, upon which rests the whole structure of the science as understood at present.

The controversy between Priestley and Lavoisier as to the discovery of oxygen is historical; but there cannot be much doubt that Lavoisier obtained his first knowledge of what Priestley called "dephlogisticated air" from the English chemist. Priestley distinctly states that he mentioned the discovery to Lavoisier at a dinner-party in Paris in 1774, and that it was received by the entire company as an entirely new fact. Scheele in Sweden also discovered it independently about the same time, but did not understand its importance from a theoretical standpoint.

The exact part which any one of these early chemists took in the development of the science is, however, of little practical consequence. To four men — Priestley, Lavoisier, Cavendish, and Scheele — belongs the honor of having brought chemistry out from the darkness of mediæval ignorance and superstition, and raised it to the dignity of a true science based on a comprehensible and rational theory. It is a curious fact that all these men were more or less unfortunate in their lives. Cavendish, eccentric almost to insanity, died alone in his chamber, with no friend or relative to comfort his last moments. Scheele met with a premature death by disease at the age of forty-three. The house of Priestley was destroyed by a mob, and he afterwards emigrated to America, ending his days on a Pennsylvania farm. The tragic end of Lavoisier has already been described. Few men have deserved less the treatment they received from their fellow-beings than the two last mentioned.

ORIENTAL RAILROADS.

FOR political reasons the south-western part of Asia lying between Europe and Hindoostan has lately become the scene of active opera-



tions in railroad-building. The Russians are extending their lines into Afghanistan from the north, while the British are building branches from the East-Indian system over the mountain-passes and into the desert beyond; both aiming for the city of Herat, the possession of which is of the greatest importance from a strategetical point of view.

The accompanying map is from *La Nature*, and shows very clearly the roads projected and completed, both in Afghanistan, and Persia and Asia Minor; these latter roads, however, are of more importance commercially than from a military standpoint, and therefore less likely to be immediately constructed.

Starting from the frontier of Hindoostan, where connection is made with the extensive railroad system of that country, the English have constructed two roads towards Herat, — one leading from Lahore *via* Pechawar and Cabul, and the other passing through Beloochistan by way of Quetta and Kandahar. These lines are at present finished to Pechawar and Quetta only, but are constantly being extended.

The Russians, on the other hand, are building

a road towards Herat from Mikailovsk on the Caspian Sea through Askabad and Sarachs. Another road starting from Sarachs runs northeast to Merv and Bokhara. It will be open to Bokhara by next January, and will ultimately be extended to Samarcand and Tashkend, there joining another line from Orenburg in Eastern Russia, which is already connected with the Russian system.

Scarcely three hundred miles at present separate the termini of the English and Russian lines, and at no distant date it seems as if there must be a fierce struggle for commercial and political supremacy. As the writer in *La Nature naïvely* remarks, "After a fight between the two nations, with a probable Russian victory, the Indian and European trunk lines will be finally connected."

Whatever may be the result of the contest, the ultimate result will doubtless be as stated above, and the advantages of such a line of railroad are evident. The time from Paris to Lahore, on the Indian frontier, by way of Odessa, Bakou, the Caspian Sea, and Herat, will be reduced to fifteen days, and, when the line *via* Orenburg and Samarcand is finished, to thirteen days; and it is not impossible that before many years passengers may travel in a Pullman car from Paris to Calcutta or Bombay in a fortnight's time.

The map also shows other projected lines, all having the same ultimate end, — the connection of Europe with the East. Starting from Bender-Bouchir on the Persian Gulf, already having steamship communication with India, a line is intended to run northward to Ispahan and Teheran in Persia, and thence running to Bakou, or else following the present caravan trails to Tiflis or Trebizond. A more important line, and one more likely to be soon built, is to start from Alexandretta on the Mediterranean Sea, and pass down the valley of the Tigris past Mosul (the site of Nineveh) and Bagdad, to Bassorah on the Persian Gulf, there connecting with steamships for East-Indian ports. An extension of this line through Asia Minor, is also planned to Scutari, opposite Constantinople, so that the Bosphorus will be the only interruption to a continuous railroad journey between Europe and Western Asia.

Nearly all of these projected roads run through a fertile and well-populated country, which can furnish a large local business in addition to the through traffic between Europe and Asia, and are capable of much greater development under improved commercial and political conditions. In olden times the valleys of the Tigris and Euphrates were the principal routes between the two continents; and although the idea of a railroad train rushing past the ruins of Nineveh and Babylon, and entering a modern-built station in the Oriental cities of Bagdad, Aleppo, or Teheran, seems rather incongruous, these roads may yet be the means of restoring those cities to their ancient importance, and will certainly bring to those remote and semi-civilized peoples the same benefits which they have conferred upon the more progressive Western nations.

[Specially reported for the *Popular Science News*.]

THE AMERICAN ASSOCIATION AT NEW YORK.

BY K. B. CLAYPOLE.

The meeting of the American Association for the Advancement of Science held last August in the city of New York will long be remembered for its courteous welcome from the trustees of Columbia College, the Academy of Sciences, and the Torrey Botanical Club. So great, also, was the number of the members present, and so excellently had the local committee provided for their convenience and entertainment, that unusual opportunities were afforded for that interchange of thought and opinion that is one of the main objects of the Association.

The opening exercises were held in the library of Columbia College, and it was in this room that Professor Morse delivered his address as retiring president, giving in one hour a brilliant sketch of the work done in the last eleven years by American zoölogists, and showing that, almost without exception, the results supported Darwin's theory of natural selection. It was in the library also that the meeting assembled one evening to hear some of the personal experiences and observations of Professor Drummond of Glasgow during a year's survey of the "heart of Africa." In the tropical forests of this unglaciated region it seemed to him that mimicry among animals was not only the rule, but the sole condition, of life; and in the insect world he found it carried to a pitch that is almost incredible to those who have not seen it for themselves. The leaves and bark of trees, lichens, mosses, and fungi are constantly taken as models; and the larvæ of one insect lie fearlessly exposed on bare stones during the brightest hours of the day, protected by the form of a splash of bird droppings. The grass-blade insect, with its legs stretched in rigid spikes, and its antennæ erected like blades coming from a node, cannot be distinguished from a wisp of hay. When, however, after the rains, the new grasses spring up, these hay-like insects disappear, and their places are taken by others of vivid green. The Central African, with his few wants and absolute vacuity of mind, was well sketched by Professor Drummond; and when he showed us this child of nature lowered into his grave with a string of beads, and a bow broken to show that its use was gone, the sole accumulations of fifty years of life, we felt that we had never before realized how much man might do without and still be man.

But the Association, comprising as it does many and divers interests, cannot meet often as a whole. It is therefore divided according to subjects, and eight sessions are held simultaneously during the morning and afternoon of at least four days of the meeting. In these "sections," as they are called, members bring forward the original work that has recently occupied them; sometimes interesting only a few specialists in the subject, and sometimes attracting members from the other rooms. A large audience assembled to hear Thomas A. Edison's account of his new invention, — a machine for producing electricity directly from fuel. This "pyromagnetic dynamo," as he calls it, is now actually in use, and the results thus far obtained lead to the conclusion that the economy of production of electric energy from fuel will be at least equal to that of any of the methods already employed. The actual output of the dynamo will be less than that of an ordinary dynamo of the same weight. Since, however, the new dynamo will not interfere with using the excess of energy of the coal for warming the house itself, and since there is no attendance required to keep the machine at work, there would seem to be a large field of usefulness for it.

A great many members were occupied for a whole afternoon with the scheme of a canal across Central America, to be undertaken by the United States. The difficulties that threaten the success of the sea-level canal now in course of construction at Panama, were dwelt on at length by Commander Taylor of the United States Navy. At the same time, he showed the advantages of taking a route through Lake Nicaragua and the San Juan River. These were for the most part purely prospective, though the absence of calms in this part of the Isthmus, and the favorable winds both for entry and exit at the canal openings, would be an actual gain to sailing-ships. The engineering features of the proposed canal were given in detail from the results of the last survey of the United States government, with an estimate of the total expenses and the time required for the work of construction. The beauty, fertility, and salubrity of the Pacific slope of Nicaragua were pointed out, the supply of fresh provisions was said to be abundant, and the drinking-water to be good from one end of the line to the other.

Geology in some of its features is always attractive at these meetings, and the room was well filled when Dr. Newberry gave an account of the fossil fishes lately taken from the Cleveland shales, — monsters that with heads five feet across, and massive jaws, must have been the terror of the Devonian seas. Great interest was also taken in some magnificent specimens, exhibited by Mr. George Kunz, of agatized and jasperized wood from Chalcedony Park, Arizona, — polished slabs of perfect agate or jasper large enough for table-tops, showing the medullary rays and every other marking of a section of a tree. A pillar twenty-four inches high, cut transversely across the stem, and polished by a railroad employee in Arizona, was especially beautified. Photographs showed these trees lying where they had drifted and slowly petrified. On the same table were displayed a lump of meteoric iron from Arizona weighing about one hundred pounds, and an enormous Mexican axe of polished jade bearing on one side the decidedly Mongolian features of a deity.

Problems relating to labor received close attention from the economists. Professor James of Philadelphia expressed his dissent from Mr. Atkinson and his party, who hold, that, as a nation, we have every reason to congratulate ourselves on our unparalleled increase in wealth, and the satisfactory methods of its distribution. Professor James finds that the conditions of life are becoming more severe as the years roll on. The prizes open to the successful are growing larger, but the number of blanks is also rapidly increasing. Even in this country a class of agricultural laborers is growing up which has no outlook toward any thing better than being dependent wage-receivers, hence the struggle to better this condition by demanding more wages. In this he sees the basis of a bitter and long-continued struggle, calling for all our wisdom and forbearance.

It was generally felt in this section that the condition of the workingman might be improved if he could be persuaded that economy is respectable, and be taught how to economize. Professor Atwater, in his papers on "The Physiological and Pecuniary Economy of Food" and "The Food of Workingmen in Relation to Work done," stated that the working-class of the United States are extravagant both in the price they pay for their food and in the quantity they consume and waste. He explained the elements of the common foods that combine to form the structure of the human system and supply it with potential energy; then, with the

help of diagrams, he showed the amount of these elements contained in various foods, and the cost of a pound of actual nourishment, dwelling with emphasis on the facts that the nutrients of vegetable food are much less costly than those of animal food, and that the less expensive kinds of meat contain as much nutriment as those which command a high price. A long discussion followed these papers, in which it appeared that some allowance must be made for idiosyncrasies, for differences of flavor, for digestion, and for the ability of the stomach to extract every grain of nourishment from any given food. Papers on cooking and cooking classes came next, and then the attention of the section was claimed for the subject of manual training in our public schools. President Woodward of St. Louis stated, as a result of the introduction of the system into Washington College, that, after three years of manual training, every boy of ordinary brain-power could make a success of any trade or occupation that he went into. Professor James declared the adoption of this feature into our public schools was demanded alike in the interest of sound intellectual training and by the economic condition of the couutry. Under the present system one side only of a child is trained, and after graduation he finds all the callings for which he is fitted overcrowded. Let children feel that in manual labor is a field for intellectual qualities, for ingenuity and knowledge, and a perfect revolution will be effected in their attitude toward these things. Along this line, too, we must look for a gradual elevation of the social tone of our workmen. At the close of the discussions bearing on labor, Mr. Yan Phou Lee, the young Chinaman who graduated with honors at Yale last June, spoke with great eloquence and much sarcasm on "The Chinese Question from a Chinese Stand-point." In the anthropological section some time also was given to China in America, particularly in regard to the social life of the Chinese in the Eastern cities of the United States. In this room the Indians and their customs and relics received attention. Members of every department, however, were glad to hear from Professor Putnam that the Serpent Mound of Adams County, O., the only animal mound in the State, had been saved from threatened destruction; Miss Alice Fletcher and other ladies having collected money enough to buy it with the land adjacent, and preserve the property as a public park. Satisfaction was also felt when Mr. Doremus announced, that, by saturating the surface of the obelisk in Central Park with melted paraffine wax, he had for the last two winters successfully prevented that peeling-off of fragments, and even large slabs, by the frost and rain, which had already removed more than seven hundred pounds.

Excursions were arranged during the meeting for the purpose of bringing the scientists together, and of enabling them to see what was especially interesting to them in New York and its neighborhood. Some of these excursions included all the members of the Association, while others, such as the inspection of the trap and sandstone exposures of the Palisades and Bergen Ridge by the geologists, were for particular sections only. The botanists and entomologists of the Association held regular club-meetings, and together saw something of the New Jersey plants and insects at Sandy Hook, in company with the Staten Island Naturalists and the Torrey Botanical Club. To this latter society the thanks of the botanists are also due for the opportunity of inspecting the Torrey Herbarium and Library, and for gifts of botanical specimens characteristic of the coast and piue barrens of New Jersey. The next meeting will be held at Cleveland, O.

[Special correspondence of the *Popular Science News.*]

PARIS LETTER.

A PAPER which will prove very interesting to those concerned with vegetable physiology and with agricultural pursuits is that which has been recently published in the *Revue Scientifique* by M. Dehérain on the late Boussingault's work in that line (No. 2, July 9, 1887). The paper is a very good one, in which Boussingault's important work is well reviewed; and it shows how much modern agricultural chemistry owes to this great chemist, whose work began at a time when the chemical composition of hay was utterly ignored, as he himself remarked to one of his pupils.

THE Academy of Sciences has recently appointed Pasteur *secrétaire perpétuel* in the late Vulpian's place. The choice is unanimously disapproved. Pasteur is not the man to fulfil the duties of the post, which is an important one, and requires an active and pleasant man. Pasteur is active, but for his own business only, and will not care enough about the interests of the Academy. A pleasant man he has never been, nor is ever likely to become. The Academy could not refuse electing him, as he wished it; but it is a great pity he has not kept quiet, and let some other man be elected.

In the Medical School M. Ch. Richet has been elected to the professorship of physiology in the late Beclard's place, and in the Scientific Faculty M. Dastre is elected in Paul Bert's place.

PROFESSOR METSCHINKOFF publishes, in to-day's number of the *Annales de l'Institut Pasteur*, a very interesting study on the fight which is carried on in living organisms between bacteria and similar beings brought from without and the cells of living organisms, — cells which he calls *phagocytes*, and are of two orders: the *leucocytes*, or white blood-corpuscles, and the conjunctive cells, which are similar to the preceding, except that they do not move about, but keep always quiet. This fight Metschinkoff has witnessed for the first time on some daphnia, — small fresh-water crustaceans which are subject to become victims to a *monospora*, a fungus of inferior order. As soon as a monospora invades a daphnia, the leucocytes swarm around it, surround it, and destroy it by a process of intracellular digestion. In eighty per cent of the cases the leucocytes are successful, and entirely kill the monospora; in tweuty per cent the monospora gets the best of them, and the daphnia perishes, being unable to sustain the fight. In all cases of parasitic disease the result to the organism depends on the result of this fight, which occurs more or less in all cases, from man downwards. In some rare cases there is no fight: for instance, in cases of *choléra des poules* the bacteria multiply and grow freely, without any show of fight on the part of the phagocytes of the hen; in the guinea-pig, on the contrary, the phagocytes work in a very energetic manner, and the consequence is, that they generally succeed in destroying the bacteria, aud the guinea-pig is saved. In some cases, such as that of *charbon*, caused by *bacillus anthracis*, the leucocytes take no part at all in the fight, and it is only the phagocytes of the spleen who do something; but they are not numerous enough, aud are nearly always defeated. When an *attenuated* virus of *bacillus anthracis* is locally injected, on the coutrary, the leucocytes fight well, and it is easy to see within their envelope a number of dead bacilli.

In order to ascertain whether this fight between parasitic fungi and the phagocytes of the body is a regular circumstance, notwithstanding some exceptions, Professor Metschinkoff has extended his iuvestigations to a great number of parasitic diseases; and he has seen that the fight takes place in erysipelas, in malarial fever, in typhus-fever, and other diseases. In other cases it also takes place, but without any very marked result; because, although the phagocytes do take the fungi into the interior of their cell, they cannot digest nor destroy them, on account of the thickness and vitality of the exterior membrane of the fungi. Such is the case, for instance, with tubercular or leprous bacilli. The fight between phagocytes and fungi is, therefore, a common phenomenon; the differences in the result of it being due to the fact that it is not always successful, and that it does not always begin soon enough. Professor Metschinkoff draws an interesting parallel between the inflammatory reaction in warm-blooded animals, which consists in a migration of leucocytes out of the bloodvessels, and the reaction which takes place in animals which are deprived of blood, or of cold blood, in which there also occurs a migration of phagocytes. In both cases the phagocytes surround the foreign bodies, and try to destroy them. This process is quite similar to that which obtains in sponges for digestive purposes: all foreign bodies, whether alimentary or not, are soon surrounded by amoeboid cells, which are real phagocytes. This very interesting theory of Metschinkoff throws an entirely new light on a difficult question, — that of the *modus agendi* of parasitic fungi, — and completes Pasteur's theories on that point, showing that parasitic diseases are merely the result of intercellular warfare going on between cellular fungi and elementary cells, very similar in many points to amoebas and such organisms.

Concerning the same question of parasitic diseases, I would call attention to a paper recently read before the Academy of Sciences by M. Galtier, which concludes by saying that the tubercular bacillus is one of the most refractory to destroying influences such as desiccation, putrefaction, freezing, etc., and that none of the methods of practical appliance are potent enough to destroy them in houses, bed-material, carpets, etc., when a tubercular patient has lived in them for some time.

AN interesting feature of the exhibition which has been recently opened in Havre cousists of a collection of venomous and poisonous fishes, — those which are unhealthy to eat, and those which are endowed with poisonous glands. There is also a fine collection of bacteria, prepared by Professor Cornil of Paris. A new caual has just been opened between Havre and the Seine River. It is a short one, of only twenty-five kilometers length, but will render good service in furnishing a better route for boats than that afforded by the lower part of the Seine.

A FINE meteor has been recently observed in France, in the departments of Seine, Seine-et-Oise, aud Loiret. It went in a south-westerly direction, and its diameter was about a tenth of that of the moon. A very distinct rumbling noise accompanied its progress, and it left behind a long, luminous track. It is conjectured that it was at some forty kilometers height in the air when it exploded. This fact would prove, that, even at such heights, the atmosphere is dense enough to oppose such resistance as to cause the meteor to become incandescent.

A FRENCH investigator, M. Quinquaud, has recently studied the influence of cold and hot baths upon the respiratory and nutritive processes. His conclusion is, that under the influence of cold baths more oxygen is absorbed and more carbonic acid is expelled. At the same time, more air passes through the lungs. Hot baths act in a similar manner, but in a less marked degree.

A new remedy against meningeal inflammation is tannin. Dr. Dubonć uses it in doses up to six grams *per diem*, and reports very favorable results; but the way in which it acts is not very well explainable.

The Paris University comprises at present 10,679 students, of which 3,696 are medical students, 467 students in the scientific faculty, and 1,766 students in pharmacy. There are 167 women students, among which 108 are in the medical school, 7 in the scientific, and 1 in the law school.

H.

Paris, *July* 29, 1887.

[Original in *Popular Science News.*]

NOTES ON THE OSAR.

BY W. R. LIGHTON.

Scattered widely over the surface of the area which is covered by the glacial drift, are occasional mounds and ridges, called osars, which are of unmistakable drift origin, and yet differ considerably in physical character from that material which is generally known by the name "drift." These mounds and ridges commonly rest upon the unmodified bowlder-clay, which is composed of large and small rounded bowlders, pebbles, sand, and clay, all mixed up together, without stratification or any appearance of the assortment which would be seen if the material had been deposited under the action of water, so we know that this deposition has taken place in some other way, and all the evidence gathered tends to show that it has occurred under the grinding and tearing action of a forward-moving sheet of ice. This arrangement, or rather lack of arrangement, of the bowlder-clay, is what would be expected under such conditions, and is just what we see in our glaciers of to-day; and the name "sub-glacial" has been applied to the formation.

A division of the bowlder-clay has been made by geologists, and another material described which bears a close resemblance to the sub-glacial, but the bowlders and pebbles are less rounded, scored, and scratched, and the iron which is contained in the clay is more highly oxidized. This material is supposed to have been borne along upon the surface of, or imbedded in, the ice-sheet, and to have been deposited as the ice melted, and so it has been called "super-glacial;" but these two classes are so similar in character and derivation, that it will be sufficient for us, in this paper, to consider them as identical.

These mounds and ridges of which I have spoken, differ in physical character from the underlying clay in being composed almost entirely of finer material, such as gravel, sand, and clay, with very few of the bowlders which are present in the beds below. This fact, and the fact of their resting upon the bowlder-clay, sufficiently prove that they have been formed since the clay was deposited; and the most satisfactory explanation of their formation is this: —

As the great ice-sheet melted at the close of the glacial epoch, the water which resulted from the melting flowed off in torrents in the direction which the ice had taken, but, of course, at a much greater speed; and although these currents would not carry the large bowlders along, as the ice had done, yet they could carry a great amount of finer material, like that of which the osar is composed. It is a familiar principle that the ability of a current of water to carry solid matter in suspension depends upon the rapidity of its flow. As the velocity of the stream increases, the amount of material which it is able to carry with it is also increases, but in a constantly increasing ratio, so it is easily to be seen that in the more rapidly moving streams but a very slight retardation of the strength of the current is sufficient to cause it to deposit some of the matter held in suspension. This stream of water, flowing off from the melting ice-sheet, would, as a matter of course, frequently carry with it bergs which had been broken off from the constantly receding mass; and these, in floating with the current, would sometimes become stranded upon the bottom of the stream, as we see bergs stranded to-day, and, as the clay and sand-laden torrent passed this obstruction, its velocity would be decreased on the down-stream side, some of its solid matter deposited, and a mound would be gradually formed, which would remain when the berg afterwards melted.

I have just seen a curious illustration of the principle of the formation of the osar in the Missouri River here. The current is very strong, and consequently a large amount of the fine sand and mud peculiar to this stream is carried in suspension, and a considerable sediment is deposited at every bend in the stream, or wherever the current is slackened. As the water fell this spring, the main channel was on the Kansas side of the river-bed, and a great extent of sand-bar formed in the middle of the bed.

Just before this bar emerged from the water, and while the water covering it was very shallow, a large log, with roots attached, floated down stream; and the roots, dragging below the surface, caught upon the submerged bar and stopped the log; the current eddying around the log was slightly decreased in velocity, and deposited some of its sand and mud on the lower side. This deposit gradually accumulated until a bar was formed above the surface extending one hundred and eighty feet down stream, while its greatest width was less than six feet. The longer axis of the bar was, of course, exactly parallel to the direction of the current. This bar has lengthened and widened, until it is now many acres in extent.

Leavenworth, Kan., *Aug.* 2.

[Original in *Popular Science News.*]

BENEFITS OF THE MOON.

The moon ministers to human wants in several ways that are not so apparent as its light-giving function, although some of them are much more important. It is by observing the position of the moon with reference to the fixed stars that the navigator determines his longitude. Upon the revolution of the moon about the earth is based a convenient division of time — the month — intermediate between that furnished by the earth's daily rotation and its revolution through its orbit. Doubtful points in ancient chronology have been frequently settled by means of eclipses of the moon, the dates of which could be accurately determined. The intervention of the moon in eclipsing the sun gave astronomers the opportunities for obtaining their first knowledge in regard to the solar envelope. But the largest effects on human welfare are produced by the moon through the agency of the tides. Twice a day the decomposing organic matter brought down to the seashore by rivers, or deposited along the water's edge by human agency, is swept away by the tidal wave in its course around the globe. This sanitary service which the moon performs is of inconceivable value. In many harbors, large ships and heavily loaded rafts and barges are moved from the entrance to their wharves, miles above, by that slow but powerful tug, the flood-tide. An amount of work is thus done, which, if it had to be provided by artificial means, would cost for such a port as London thousands, perhaps millions, of pounds yearly.

F.

SCIENTIFIC BREVITIES.

The Power of the Camera. — The photographer's lens is more discerning than the naked eye. A recent photograph of a figure-painting by an American artist shows that a woman's gown was first painted a hue and texture very different from that finally chosen, the underlying brushwork appearing plainly in the photograph, though not seen by the most attentive observer of the original picture. In like manner photography reveals stars that to the human eye are not distinguishable from nebulous matter.

"The Four Elements." — The evolution of chaos into earth, air, fire, and water can be represented in the following manner: In a narrow phial or glass tube, pour mercury to the height of one-fourth of its capacity; for the next fourth, add a saturated solution of subcarbonate of potash; next fourth, methylated or pure spirits of wine, tinted blue; and lastly, turpentine tinted red. On shaking this mixture together, you will have a representation of chaos; but soon, on resting, the elements will separate themselves, and the mercury will represent earth, the blue spirit air, the red turpentine fire, and the colorless potash solution water.

The Magnetic Effect of Earthquakes. — At various magnetic observatories on the continent of Europe, slight disturbances were registered, which apparently were connected in time with the late earthquakes. M. Mascart believes that a more careful examination of the records of different observations will show the connection which may exist between the two disturbances.

Weather Prognosticators. — An item in the *Rundschau* (Prague) states that patented weather prognosticators are sold in the market in the shape of a landscape with blue heavens, green grass, and trees, with yellow background, etc. With increasing moisture in the atmosphere, the blue heavens assume a dirty red hue, the other colors changing at the same time. The colors used in these drawings are made with the salts of cobalt, which are very sensitive to moisture. This sensitiveness is still further increased by using gelatine in mixing the colors.

The Atomic Weight of Gold. — Gerhard Krüss has determined the atomic weight of gold by the analysis of neutral trichloride and of potassium gold bromide. For a mean value he has found 196.669, the maximum of five methods being 196.741, while the minimum was 196 619. He regards 196.64 as the atomic weight most probably correct.

A Long Flight. — We find the following item in an English exchange, but have never seen the matter referred to in American journals, and are unable to confirm its truth: "Henry Wagner of Boston sent by steamer nine carrier pigeons to London, where they were given their freedom; and the whole number started upon their long journey across the Atlantic. Up to the time the report was given, the owner had received three of the birds. One of them went direct to Boston; another was captured near New York; and the third was found on the summit of the Alleghany Mountains in an exhausted condition by a man who picked it up, took it to his house, and warmed and fed it. On the wing of the pigeon was found the following: 'If this bird is caught or shot, notify Henry Wagner, Boston, Mass.' The finder promptly shipped the bird to the owner at this address. This is one of the longest flies on record."

The largest ocean steamships cannot be stopped, when under full headway, within a distance of from one to three miles.

A new German air-thermometer indicates the temperature to the $\frac{1}{1000}$ of a Centigrade degree.

Practical Chemistry and the Arts.

WHAT CHEMISTRY HAS DONE FOR THE ARTS.

At the beginning of the present century the line between organic and inorganic chemistry was very sharply drawn. It was considered impossible to produce artificially any organic substance, and the action of a living organism was supposed to be absolutely essential to the formation of the great variety of carbon compounds generally termed organic.

In 1828, however, Wöhler proved that when an inorganic salt known as ammonium isocyanate, $NH_4 — (NCO)$ was evaporated from its solution, it changed spontaneously into urea, an excretory product of the human body. There was no change of composition, but the arrangement of the constituent atoms was changed, so that the rational symbol of urea would be $\frac{NH_2}{NH_2}\!\!>\!\!CO$. Here was an undoubted example of the formation of a so-called organic substance without the aid of any mysterious "vital force;" and once the attention of chemists was called to the fact, the number of such substances rapidly increased, and among them are many of the highest technical importance.

Previous to 1868 madder was an important article of commerce, and large farms were entirely devoted to raising the plant for the manufacture of the brilliant dyeing material alizarine. In that year, however, Graebe and Liebermann, while investigating that alizarine, noticed its similarity of molecular structure to anthracene, a waste product of gas-works; and they soon found that it was an easy matter to produce from that hitherto worthless substance an artificial alizarine which was equal in every respect to that formed by the madder-plant. This artificial product is now used almost exclusively for dyeing, and the unfortunate madder-planters have had to find some more profitable crop.

Indigo is another coloring-matter that has been formed artificially, but the process is as yet so complicated and expensive that it cannot be manufactured on a commercial scale. It is not improbable that in the future the indigo-plant will meet the fate of the madder, and be superseded by the artificial product.

Less progress has been made in the production of the medicinal agents morphine, quinine, etc.; but even these may some time be cheaply manufactured in the chemist's laboratory.

The long list of aniline colors is another valuable contribution of chemistry to the dyeing industry. From the black, dirty, ill-smelling coal-tar, we obtain a series of hues of every shade, rivalling the rainbow in brilliancy, and, unfortunately, fading almost as quickly. Nevertheless, they are at present used in enormous quantities; and to the German chemist Hofmann we owe most of our present knowledge of this remarkable and valuable series of derivatives of aniline.

The fact that by the action of acid, starch can be changed into glucose or grape sugar, has been the foundation of an industry which in late years has reached enormous proportions. Unfortunately, one of the principal uses of this substance is to adulterate the more expensive forms of saccharose or cane-sugar; but if properly made, it is not unwholesome in itself, and, if sold on its own merits, is a cheap substitute for the more costly forms of sweetening.

Not many years ago steel was a very costly article, and only used when a stronger metal than iron was absolutely necessary. Chemical analysis showed the difference between the composition of the two; and the Bessemer process of steel-making, with its later modification in the "basic process," has rendered it possible to produce a high grade of steel at a price even lower than that of iron. Steel rails are now almost exclusively used on railroads, and it is impossible to calculate the benefits which this single invention has conferred upon mankind.

In the extraction and reduction of other metals from their ores, silver and gold are now separated from ores which were formerly considered worthless. The waste-heaps of old mines, when worked over by the modern methods, yield up a profitable percentage of the precious metal. Nickel, from being merely a curiosity, has become an important article of commerce, the demand for it being greatly increased since the discovery of the process of electroplating, by which we can deposit it at small expense upon brass, copper, or iron, giving to those metals a coating nearly as brilliant as silver, and much more durable.

A list of the applications of chemistry to the arts might be extended almost indefinitely. We may mention the discovery of nitro-glycerine and similar explosives, without the aid of which many of our great engineering works, like the Hoosac or Mont Cenis tunnels could never have been accomplished. The manufacture of illuminating-gas and kerosene oil are also chemical processes. The manufacture of soda-ash or carbonate of soda from common salt is of the highest commercial importance, and there is hardly a single branch of industry which does not consume more or less oil of vitriol or sulphuric acid. A variation in the price of this indispensable article is felt over the entire industrial world. In fact, the applications of chemistry to the arts are innumerable, and few persons realize to what extent the happiness and welfare of mankind have been advanced by the arduous, patient, and too often unrewarded, labors of the chemical investigator.

AN AMUSING APPLICATION OF PHOTOGRAPHY.

It is well known that all light falling upon a perfectly black surface is absorbed, and a photographic plate exposed in a camera pointed towards such a surface will be entirely unacted upon. The most intense black is produced simply by absence of light, and the entrance to a cave or the open door of a perfectly dark room forms a photographic background suitable for the production of some very amusing pictures.

If a person stands before such a black background and is photographed, only that part of the plate will be affected which receives the light reflected from himself. If he then changes his position so that his image falls upon another part of the plate, both images will appear in the same picture when developed; and a photograph can thus be made in which a person is apparently shaking hands with himself, playing a game of cards with his double, or offering him refreshments. By giving one image a very short exposure, a strikingly "spiritual" photograph can be obtained, in which the "astral body" will bear a very strong resemblance to the mundane one.

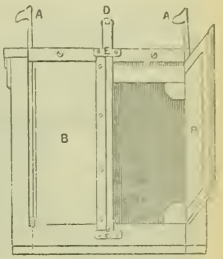


Fig. 1.

As a perfectly dark background is not always available, a French photographer, M. Duc, has invented a form of plate-holder by which two opposite sides of the same plate can be exposed at different times. The construction is evident from the engraving (Fig. 1). The doors, *B*, *B*, are opened by the pieces of metal, *A*, *A*. *D* is a strip of sheet metal which is only used to cover the crack between the two doors, and is drawn out after the holder is placed in the camera. A line exactly corresponding to the division in the plate-holder is drawn on the focussing glass, to insure accuracy in adjusting the different positions of the sitter.

Fig. 2.

Figs. 2 and 3 show some of the results obtained by M. Duc with this plate-holder.

In Fig. 2 the painter, easel, and stool were first photographed on one-half of the plate; then, putting on his coat and hat, the artist transformed himself into a model, and was again taken on the other half. The portrait on the easel is still the same person, but was added afterwards to the proof, and not directly photographed. Fig. 3 was taken in the same way, except that the hat was fixed in the proper position, and the sitter simply

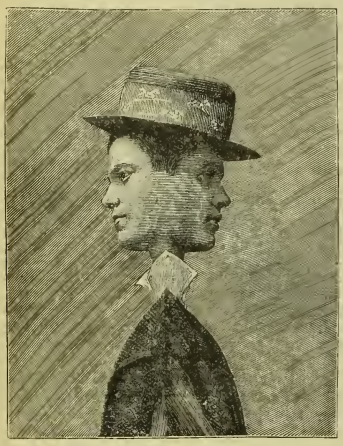


Fig. 3.

changed his position under it as the opposite sides of the plate were exposed.

Many variations of this process will doubtless occur to those familiar with photography; and a plate-holder like the one described can easily be made by any carpenter or cabinet-maker, which will be the source of much amusement and mystification.

M. Duc's invention is described in *La Nature*, from which we copy the illustrations.

A PECULIAR PROPERTY OF TIN.

A remarkable example of metamorphosis in an elemental species is afforded by tin, which, when exposed to great natural cold, is changed from the white, tough, malleable metal having a specific gravity of about 7.30, to a gray, brittle, crystalline body of much less density. This change takes place not only in pure block tin, but, as observed by Richards, in ingots containing 2.5 per cent of mercury; the change at a minimum temperature of about $-180°$ gradually extending, in this case, from certain centres, so as in a few weeks to involve the whole mass, which had a radiated structure, and was compared in aspect to stibnite. Its density was found by Richards to be 6.175; that of the unchanged portions being 7.387. Other observers have found for this altered form, with pure tin, densities of 6 0, and even of 5.8. Its instability makes this determination difficult, since the gray, brittle species is readily changed into white tin by strong pressure, by a sudden blow, or by immersion in hot water, which restores to it its toughness, and its original density of 7.30. The gray tin exhibits, alike in acid and in alkaline liquids, electrical relations different from those of the ordinary metal.

This metamorphosis of tin is comparable to that of water into ice by cold, or that of aragonite into calcite by heat; the transformation in each case being one of homogeneous disintegration from a denser to a lighter species. It is not improbable that similar changes of state analogous to this may take place in other bodies, and that the temporary production of a similarly brittle and chemically unstable form of iron, under like circumstances, may explain the apparently ready frangibility of that metal when exposed to severe frosts. — From *A New Basis for Chemistry*, by T. Sterry Hunt.

A NEW HEAT-MEASURER.

Mr. C. Vernon Boys exhibited an instrument, which he terms the Radiomicrometer, to the Royal Society, March 24 The instrument is a modification of one invented by M. D'Arsonval, and consists of a minute thermal junction forming one side of a parallelogram of which the other three sides are of copper. This thermo-electric circuit is suspended between the poles of a magnet It is evident, that, when radiant heat falls upon the thermo electric junction forming one side of the parallelogram, an electrical current is formed which turns in the magnetic field, where it is placed so as to include the greatest number of lines of force. The parallelogram made by Mr. Boys embraced one square centimeter. The thermo-electric junction consisted of a bar of antimony and of bismuth. each piece being $5 \times 5 \times \frac{1}{4}$mm., soldered edge to edge. The circuit was supported by a torsion fibre, and provided with a little mirror. With a magnetic field of only a hundred units, the instrument showed the heat which would be cast on a halfpenny by a candle-flame at a distance of 1,168 feet. With a stronger magnetic field, the instrument is capable of much greater sensitiveness. The author calculates that an instrument can be made which would show a change of temperature at the junction of $\frac{1}{10000000}$ of a degree of heat. Mr. Boys also showed a motor which consisted of a cross, the centre being antimony, and the arms bismuth: to the ends of the arms are soldered four copper wires, the three ends of which are joined by a ring of copper. When the spark from a blown-out match is held near this arrangement, it rotates rapidly. If the spark is held on the right-hand side of the north pole, the motor revolves indifferently in either direction. If the spark is held on the left-hand side, the motor stops. "We have, therefore, an electric magnetic motor which goes, having neither sliding nor liquid contacts." — *Nature.*

A CHEAP GAS-HOLDER.

Professor I. R. Dean of Huntsville, Tex., send us the following method of makiug a useful gas-holder at a very small expense: —

Take two empty kerosene-oil cans, and, having cut out the upper ends, invert them, and make in one of them a round hole half an inch in diameter, and in the other make two holes of the same dimensions. Bring the cans as close together as possible, and solder one end of a U-shaped half-inch tin tube over the hole in the first can, and the other end over one of the holes in the second can. Solder a straight half-inch tube over the second hole in the second can above, and your holder is complete Next saw a whiskey-barrel in two in the middle, and fill one-half with water, and you have your water-bath.

It is hardly necessary to state that this gas-holder will not do for all kinds of gases; but, as most gases do not act on tin, it can be used for nearly all.

The value of the gold raised from the Russian soil in 1886 was computed at 25,736,000 roubles.

INDUSTRIAL MEMORANDA.

A Lock and Key for a Flea. — In 1578 Mark Scalliot, a blacksmith of London, made, "for exhibition and trial of skill, one lock of iron, steel, and brass. all of which, together with a pipe-key to it, weighed but one grain of gold." He also made a chain of gold, consisting of forty-three links; and having fastened to this the before-mentioned lock and key, he put the chain about the neck of a flea, which drew them all with ease. All these together — lock and key, chaiu and flea — weighed only one grain and a half.

The 68,200-pound anvil-block, recently cast by the Otis Iron and Steel Company of Cleveland, for the Morgan Engineering Works, is said to be the largest single steel casting ever turned out in the United States. The block is 8 feet square by 3 feet 10 inches high; 78,525 pounds of steel were melted, and this was poured in 4 minutes, 20 seconds.

A Time-Piece the Size of a Pea. — There is a watch in a Swiss museum only three-sixteenths of an inch in diameter, inserted in the top of a pencil-case. Its little dial not only indicates hours, minutes, and seconds, but also days of the month. It is a relic of the time when watches were inserted in snuff-boxes, shirt-studs, and finger-rings. Some were fantastic, — oval, octangular, cruciform, or in the shape of pearls, tulips, etc.

The Carbon in Cast-Steel. — Messrs. Ormond & Werth, of the Creusot Iron-Works, France, have recently obtained interesting results from their researches into the inner structure of cast-steel. A very thin-rolled plate was placed on a pane of glass, and carefully treated with nitric acid until the iron was all dissolved, iu such a way as to leave the carbon in its normal condition. When this skeleton was examined with the microscope, it was discovered that the carbon is not at all distributed evenly throughout the mass, but that the steel consists, in its inner structure, of tiny particles of soft iron enclosed in cells formed by the carbon. These cells are again distributed in the iron, either combined or as a collection of cells, having considerable open spaces between them, so that such a plate or sheet of steel may be rolled until it becomes transparent. These spaces are irregular in shape, and may in the raw material be almost noticeable; but they are reduced in proportion to the treatment to which the steel is subjected, either by rolling or hammering, as naturally the homogeueity is increased.

To Preserve Ropes. — *Building* says: "It is often very important to prevent the deterioration of ropes used in erecting scaffolds which are to remain up some time, and especially in places where the atmosphere is more than usually liable to attack the hemp. It has been recommended to soak the very dry ropes in a bath containing ninety grains sulphate of copper per gallon of water, allowing them to remain three or four days, afterward drying them. This treatment protects them as well against the attacks of insects. The copper may be fixed either by a coating of tar or by a solution of soap in water. For tarring the ropes it is preferable to pass them through a bath of boiling tar, then draw them through a ring which compresses them, to extract the excess of tar, afterward hanging them up to dry. In the other process the ropes are soaked in a solution of soap in water, containing four hundred and fifty grains of soap to one gallon of water. The salt of copper which forms in the fibres preserves them better than the tar, the action of which is merely mechanical."

Thermometer-Tubes have to be seasoned. This requires a year or two. When the glass is new, it changes and slowly contracts.

Home, Farm, and Garden.

[Original in *Popular Science News.*]

THE MYSTERIES OF PLANT-GROWTH.

BY FRANCIS WYATT, PH.D.

VIII.

Exhaustive and careful analyses of all species of plants have disclosed that potash exists in much larger proportion in their ashes than phosphoric acid; and it is contended, doubtless with perfect reason, that, in order to be truly fertile, a soil must contain twice as much of the former as of the latter element. With this hypothesis before us, it will be useful to bear in mind that an acre of well-constituted, ordinarily good, dry soil, having a depth of, say, nine inches, weighs three million pounds, and should not yield less than the following: —

1,000 pounds of soil = 1½ pounds phosphoric acid = 4,500 pounds per acre.

1,000 pounds of soil = 3 pounds potash = 9,000 pounds per acre.

On the other hand, the important part played by potash in plant-life may be rapidly gauged by a glance at the following table: —

Quantity of Potash removed per Acre by —

30 bushels of wheat (grain and straw) .	50 pounds.
100 bushels of corn (ears and stalks) . .	150 "
20 tons of turnips (including tops) . . .	150 "
1 ton of cotton-fibre (seeds and stalks) .	160 "
100 bushels of potatoes (including tops) .	185 "
1 ton of tobacco (leaf and stem) . . .	340 "

Taking the average consumption for all these, however, at only seventy-five pounds per annum and per acre, it will be seen that under ordinary circumstances, if no measures are adopted to replace what is taken away, the supply of potash is sufficient to stand the drain for ninety years, after which fertility will come to an end, and the crops cease to grow.

Potash is one of the chief contributors to that characteristic reaction of the soil known to chemists as alkaline; the term "alkali" being extended to a large class of substances soluble in water, and having the power to neutralize the effect of acids.

This action will be demonstrated if a piece of blue litmus paper be dipped in an acid, say common vinegar, when it will become red; but if it subsequently be dipped into a solution of common washing-soda (an alkali), the blue color will be at once restored.

This alkaline or *basic* reaction of the soil, being directly opposed to that of vegetation, which is acid, affords a contrast, the study of which is the more interesting from the fact that in an accentuated form the same alkalinity presides over the nutritive and circulating fluids of all animal life. What could better illustrate than this the opposing chemical action exercised in nature by the two great classes of living things? The minerals of the earth filter into the plants, through their rootlets, in the form of alkaline solution, permeate the ascending sap, and, entering into combination with the acids contained in their tissues, are transformed into various organic compounds. Animals feed upon these plants, and, in virtue of the exactly opposite chemical constitution of their circulating fluids, again reduce the organized substances to their mineral state, and thus, enabling them to be restored to the soil, keep up a perpetual and unchanging process.

When, instead of being mineralized by animals, plants are burned to ashes, the heat resulting from their combustion causes the dissociation of the various compounds of potash, and transforms the whole into carbonates, sulphates, and chlorides.

These salts are separated by treating the ashes with water, and evaporating the concentrated solution, and, as thus obtained, constitute the potashes so largely used in soap and glass making.

In addition to the natural silicates, carbonates, and oxides of potassium found in the soil, we possess inexhaustible supplies of natural nitrates and chlorides, deposited in various localities, either on the surface or in the interior of the earth's crust, or held in solution by the waters of the seas.

The well-known mines of Stassfurt, in Germany, formed by the drying-up of certain salt lakes, alone yield about a hundred and twenty thousand tons of potassium salts every year, by far the greater portion of which is used in Europe for agricultural purposes.

A potash salt, to be readily and truly assimilated by a plant, must be liable, when introduced into its sap, to so easy a decomposition that its liberated alkali may enter at once into the necessary combination with the organic compounds.

If, as it is applied, it be united to its acid by too strong a bond, the vegetable will be unable to effect a dissociation; and it will consequently accumulate in the tissues, and become a mere burden instead of promoting healthy growth.

This question of assimilation, therefore, is one that demands very attentive study; and it is only from the data collected by the most recent scientific discoveries in relation to the laws and powers of affinity, that we are enabled to class the various salts, according to their adaptability, in the following order: —

Carbonate, Sulphate,
Nitrate, Chloride.

The place of honor is assigned to the carbonate, because it is the most susceptible to decomposition, and therefore the most ready to part with its base to all kinds of vegetable acids.

It also, probably, has the additional advantage of imparting to the plant, or placing at its disposal, the carbonic-acid gas liberated during the internal chemical action.

It is therefore extremely unfortunate that such excellent qualities should be handicapped by obstacles sufficiently insurmountable to prevent its wholesale adoption.

The *first* of these obstacles is the ever-varying composition of the crude product. Frequently containing foreign and extremely poisonous salts, it can only be applied with the nicest discrimination.

The *second* is its price, which, when pure, is sufficiently high to keep it beyond our reach.

Thus compelled to put aside the carbonate, we may turn to the nitrate, which follows it in the order of assimilability, and which, while its constitution is so much more stable, nevertheless easily succumbs to the reducing action of the sap.

Nitrate of potassium, or nitre, or saltpetre, is found in a natural state in some parts of India, especially in Bengal, where it appears as a white incrustation on the surface of the soil, sometimes mixed with the latter to a considerable depth.

It is extracted by water; and the solution is evaporated, first, by the heat of the sun, and afterwards by artificial heat, until the salt crystallizes out.

Industrially speaking, however, the most important method of producing it consists in obtaining it from nitrate of soda (or *Chillian saltpetre*) and chloride of potassium, which, when mixed together under the influence of heat, undergo a double decomposition. In order to render more fully intelligible the production of nitrate of potassium by this means, it is necessary to be acquainted with the solubility of both salts, and of the salts produced by their mutual decomposition, thus: —

100 parts of boiling water dissolve —
218 parts of nitrate of sodium,
54 parts of chloride of potassium,
200 parts of nitrate of potassium,
37 parts of chloride of sodium.

100 parts of cold water dissolve —
50 parts of nitrate of sodium,
33 parts of chloride of potassium,
30 parts of nitrate of potassium,
36 parts of chloride of sodium.

As a general rule, when two salts in solution are brought together capable of forming, by exchange of their metals, a salt which is less soluble in the liquid, that salt will be produced and separated. Thus, when solutions of nitrate of sodium and chloride of potassium are mixed and boiled down, chloride of sodium is deposited, and nitrate of potassium remains in the boiling liquid. When this is allowed to cool, the greater part of the nitrate of potassium crystallizes out, leaving the remainder of the sodium chloride in solution.

Every hundred pounds of pure nitrate of potash contains: —

Nitric acid (anhydride) (N_2O_5)	53.46
Potassium oxide (K_2O)	46.54
	100.00

or, in other words, besides the 46½ pounds of pure potash, about 14 parts of readily assimilable nitrogen in the form of nitric acid.

Sulphate of Potash is formed by combining potassium with sulphuric acid, and is a very stable salt. The difficulty with which it is decomposed has induced many agronomic authorities to doubt its direct utility as a fertilizer, and all the experiments that have come under my own notice have failed to make its action sufficiently clear to enable me to form an absolute opinion.

Numerous cases are cited where it has given excellent results; others, equally numerous, are recorded in which its application has produced no results at all.

A very important question, therefore, and one that I much desire to see satisfactorily solved, is, whether, in the soils where it has been so successful, it has not met with some agents that have facilitated its transformation into either the carbonate or the nitrate, and thus assisted its assimilation? Until the contrary has been definitely proved, I shall certainly continue to personally take that view of the case.

In its pure state, sulphate of potash is composed of —

Potash (K_2O)	54.02
Sulphuric acid (anhydride) (SO_3) . . .	45.98
	100.00

And, although it is commercially obtained from many sources, the most important is that which consists in treating the potassium chloride of Stassfurt with sulphuric acid.

The quality offered to agriculture is generally very impure, and contains about twenty per cent of extraneous matter, chiefly consisting of chloride and sulphate of sodium, and water.

Like phosphate of lime, therefore, it should never be purchased without a guaranty of its strength, and a certificate of analysis from some competent chemist upon an authenticated sample.

This certificate should accompany each shipment, and state the degrees of potash and sulphuric acid separately; there being no other safeguard against serious mistakes or intended fraud.

Chloride, or Muriate of Potash, is a combination of potassium with chlorine, and it may be looked upon as even more difficult to decompose by plants than the sulphate.

Despite this fact, it has given some very extraordinary results in our soils, and has been the subject of a great deal of profitable research at the hands of the chemists at our agricultural experiment-stations.

When pure it is composed, in every 100 parts, of —

Potassium (K)	52.41
Chlorine (Cl)	47.59
	100.00

and therefore, as will at once be seen, it does not contain any potash at all. In order that it may furnish this salt to plants, it must, first of all, undergo a decomposition in the soil, and be reduced to the state of oxide. As the composition of potassium oxide, or what I have constantly termed *potash*, is

Potassium (K)	83.00
Oxygen (O)	17.00
	100.00

it is easy to calculate the proportion contained in a given quantity (say, 100 pounds) of the chloride by means of the following rule: —

83 : 100 :: 52.41 : x; the value of *x* being, in this case, about $63\frac{1}{2}$ pounds.

With regard to its purchase, farmers would do well to observe the same rules as those indicated in the case of the sulphate; that is to say, invariably require a rigorously exact analysis, stating the degree of purity, with each delivery.

If we assume — and our present chemical knowledge certainly warrants the assumption — that, when they are permitted to penetrate through the rootlets in their primitive state, both the sulphate and chloride of potassium are unassimilable by plants, we must necessarily conclude that their degree of efficacy will entirely depend upon the composition of the soil under treatment and upon the character of the other fertilizers with which they are compounded.

POISONOUS WILD-PLANTS.

The *May-Apple* (*Podophyllum*) is common, growing in rich woods and in adjacent fence-corners. The fruit, when ripe, is eaten by boys, but the root and leaves are poisonous. The plant bears a large white flower, and has two large, shield-shaped leaves, which are sometimes gathered for greens with fatal results. Other common names for the plant are mandrake, wild-lemon, raccoon-berry, and hog-apple.

Wild-Parsnips of several kinds are poisonous. It is well to avoid all wild-plants which in leaves or seed-stalk look like the garden-parsnip, and to remove them from the farm. The garden-parsnip sometimes runs wild, and then it, too, becomes poisonous. These plants are generally found in low grounds and along rivulets, though sometimes on high ground. The cow-parsnip is a large, coarse-looking weed, four to eight feet high, growing in rich, low ground. This plant is covered with woolly hairs; while the wild-parsnip, or cow-bane, is a smaller plant, and free from woolly hairs. The cow-bane grows in swamps, and is considered very poisonous to horned cattle.

Fool's Parsley is a small plant one to two feet high, found in waste places in the New-England States, and is quite poisonous. The water-hemlock also belongs to this family: it grows in swamps and along creeks. This plant somewhat resembles "sweet cicely;" and the lives of children are sometimes lost by their eating the roots, which are very poisonous. The only safe rule is to leave all wild-plants looking like wild-parsnips alone.

Indian Tobacco (eye-bright), a small plant to some extent used in medicine, is poisonous; but generally men and animals cannot eat enough of it to do them much harm.

Datura (thorn-apple, or jimson weed) is a common, coarse, and unsightly weed, found in rich grounds about the barn and other farm-buildings. It has heavy stems, large, much dentated leaves, large purplish or white flowers which have a mawkish odor. There is no danger from eating the leaves; but the dried seeds, found in the dry, burr-like pods, are very poisonous, and are occasionally eaten by children with fatal effects. This plant belongs to the nightshade family, and should be carefully eradicated from the farm.

Stagger-bush (lambkill, calfkill, etc.) is a shrub two and three feet high, found in many woods and on sandy plains. The plant bears somewhat leathery leaves, and pretty white flowers. It is said to kill lambs and calves, and to give sheep the staggers when they eat the leaves. Where this plant is abundant, bees cannot be safely kept, because the honey gathered from the flowers of this plant poisons the whole product.

The *Mountain Laurel*, called also *Rhododendron*, and well known from its evergreen leaves, beautiful flowers, and crooked wood, is one of our commonest mountain shrubs. The leaves and flowers are poisonous, but are not often eaten by our domestic animals. There is a smaller laurel with narrow leaves, which is said to be more poisonous than the larger variety.

Nightshades, or bitter-sweets. There are two of these, one with black and the other with red berries. The plants being found about our houses, and the berries of bright colors, and thus attractive to children, there is considerable danger from these plants, and they should be plucked up by the careful farmer while the fruit is yet green.

Pokeweed (poke, pigeon-berry, and garget) is a plant well known for its purple berries. The young shoots are used in the early spring for "greens," or as a substitute for asparagus; but this is not a safe thing to do, as mistakes are often made, and when too old the plant is poisonous. — *Salem Gazette.*

BUTTER AND OLEOMARGARINE.

The following is quoted from Professor Atwater's article on "The Digestibility of Food" in the September *Century:* —

"In chemical composition oleomargarine stands between meat-fat and butter. It will be remembered that oleomargarine is made from beef-fat and lard by removing from them part of the stearine, which counts as the least digestible ingredient, and adding a little butter, and sometimes oil, as cotton-seed oil. The bulk of all these fatty substances — meat-fat, butter, and oil — consists of the same, or nearly the same, kinds of fat; the meat-fat having the more stearine. The butter, however, contains small quantities — seven per cent or thereabouts — of peculiar fats, butyrine, caproine, etc, which give it its flavor, and which are thought by some to make it more easily digestible, especially by persons whose digestion is enfeebled by lack of digestive juices or otherwise.

"In the excitement over oleomargarine legislation, the discussion of the relative digestibility of butter and butter substitutes has been made very active by the importance of its bearing upon their comparative values for nutriment, and many statements have been made as to the effect of the chemical composition of the peculiar butter-fats and the consequent chemical changes in the process of digestion and assimilation in the body. It is interesting to compare the very positive inferences which some writers upon the subject draw from experimental investigations, with the very guarded expressions of opinion made by the authors of the same investigations in their writings and in personal conversation. The facts at hand, and the general impression of special students of these subjects, so far as I have observed, are to the effect that probably, for healthy persons, the difference between butter and oleomargarine in ease and in completeness of digestion would be, at most, very slight, but that for people with enfeebled digestion and for infants butter may, perhaps, at times have the advantage."

GLEANINGS.

Poisoning by Squill. — Several fatal cases of poisoning by squill are reported by Dr. E. B. Truman, who, owing to the variable composition of squill, regards it as an unreliable and unsafe drug.

Blackberry-Vines should be well cultivated after the fruit has been picked. The old canes should not be cut out until late in the fall, but the new canes which are to produce next year's crops will be greatly benefited by cultivation.

Nitrate of Soda is the best fertilizer for early use, if the soil be deficient in nitrogen. It is a very useful substance, and plants appropriate it very easily. It also performs a chemical service in the soil, and supplies soda as well as nitrogen. It may be used mixed with any other kind of fertilizer.

A Novel Incubator. — The following veracious item, from an exchange, is equal to any "fish" or "snake" story we have ever seen: "Ara Soule of Grant, Minn., noticed that one of his favorite hens had ceased laying eggs, but was growing remarkably large. Finally, after attaining an astonishing size, the hen died, and Mr. Soule was curious enough to hold a post-mortem examination. He cut the hen open, and was somewhat astonished when four well-developed spring chickens popped out and began strutting about the barnyard. He supposes that some trouble with the hen's organization had stopped the egress of the eggs, and that the natural heat of her body incubated the chicken germs."

Native vs Foreign Trees. — Professor Sargent, director of the Arnold Arboretum of Harvard College, estimates that five foreign trees are planted in New England to one native; yet, of all foreign trees introduced into America, the willow alone, he thinks, has qualities not possessed in a greater degree by some native. The European oak, and the Scotch, Austrian, and Corsican pines all die at about the time when they should be at their prime; and the Norway spruce at a corresponding age is decrepit and unsightly.

Vegetable Pearls. — It is a singular and still unexplained fact that in certain species of vegetable growth there are found a variety of stones supposed to be formed and deposited in their tissues from the silicious and calcareous juices circulating in their organisms. Thus, in the bamboo a round stone is found at the joints of the cane, called "tabasheer." Another curiosity of the sort is the "cocoanut stone," found in the endosperm of the cocoanut in Java and other East-Indian islands. Dr. Kimmins describes it as a pure carbonate of lime. It is sometimes round, sometimes pear-shaped, while the appearance is that of a white pearl without much lustre. Some of the stones are as large as cherries, and as hard as felspar or opal. They are very rare, and are regarded as precious stones by the Orientals, and charms against disease or evil spirits by the natives. Stones of this kind are sometimes found in the pomegranate and other East-Indian fruits. Apatite has also been discovered in the midst of teak-wood.

The Popular Science News.

BOSTON, OCT. 1, 1887.

JAMES R. NICHOLS, M.D.
WILLIAM J. ROLFE, A.M. } . . . . . *Editors.*
AUSTIN P. NICHOLS, S.B.

SPECIAL OFFER.

New subscribers to the SCIENCE NEWS *before Dec. 1 will receive the October, November, and December numbers of this year free.*

THE POPULAR SCIENCE NEWS was the only scientific journal in the country, and, with the exception of the *New-York Times*, the only one of any class, receiving a special despatch from Professor Young's eclipse expedition to Russia.

THE "permanganate" test of the purity of water, which has been published in numerous journals, consists in adding to the suspected water a few drops of a solution of permanganate of potassium, or enough to give it a decided pink color. It is stated, that, if the color disappears in an hour or two, the water is unfit to drink; otherwise it is safe. The fact is, that this test is of little or no value. Water containing much organic matter will decompose and decolorize the permanganate more quickly than a purer specimen; but a perfectly wholesome water may have the power of decomposing this unstable salt very quickly, while a water containing disease-germs, and therefore dangerous to use, may act much more slowly upon it. At the best, this test is only a very general one, and not to be relied upon. The only sure way to determine the purity of water is to submit it to a complete chemical and microscopical examination.

BY the death of Alvan Clark, which occurred on the 19th of last August, the country loses a most remarkable man, who was known throughout the scientific world as a maker of telescope lenses superior both in size and quality to those of any other manufacturer. In 1860 he commenced work on an object-glass eighteen inches in diameter, — larger than any previously attempted; in 1872 the twenty-six-inch glass for the Washington Observatory was completed; and in 1883 one of thirty inches in diameter was produced for the Russian observatory of Pulkowa. His greatest work, however, was the thirty-six-inch glass for the Lick Observatory in California, which was successfully completed just before his death. This is the largest lens in existence, and it is not likely that it will ever be much exceeded. Mr. Clark's two sons inherit their father's genius, and will doubtless maintain the reputation of the products of their manufactory.

ANOTHER eminent American scientist, Professor Spencer F. Baird, has also passed away. Professor Baird was secretary of the Smithsonian Institution, director of the National Museum at Washington, and chief of the United States Fish Commission. His work upon the propagation and preservation of food-fishes was of great importance, and through his labors in this field our supply of many edible fishes has been largely augmented. His executive ability was of pre-eminent value in the organization and management of scientific undertakings, and his loss will be severely felt by the governmental institutions which he so ably directed.

THE microscopical — or, rather, biological — analysis of water is one of the latest developments in this direction. When we first began the study of water analysis, a determination of the amount of inorganic and organic matter, with perhaps a qualitative test for salts of nitric acid in solution, was all that was expected of the chemist; a few years later the amount of free and albuminoid ammonia was considered to be the crucial test of purity, and the significance of the presence of chlorides, as an indication of sewage contamination, began to be recognized; while in comparatively recent times, the microscope is used to detect the minute bacteria of typhoid-fever, diphtheria, or other diseases supposed to be caused by a contaminated water-supply, and in many cases they are allowed to increase and multiply upon a surface of sterilized gelatine, that their kind and quantity may be more accurately determined. All these different tests have their value, but they are still very far from that degree of accuracy assumed by a certain Englishman who sent a sample of water to a public analyst, with a request that he examine it for *scarlet-fever*, and determine how much, if any, of the disease was present.

To the popular mind there is a sort of magic in the name of Edison, and any invention which he may bring forward is likely to receive more attention than its actual importance may warrant. The "pyromagnetic motor," which he described at the recent meeting of the American Association, by which a current of electricity is produced directly from the heat of combustion, without the intervention of a steam-engine and dynamo-machine, is an ingenious and novel application of a principle which has never before been utilized, — the fact that iron loses its power of being magnetized at high temperatures. Nevertheless, we are inclined to question the practical value of the invention, which has been heralded by certain journals in much the same terms as was the secondary battery. Mr. Edison himself states that he has not found it to be any more efficient in transforming the energy of combustion into electricity than the present methods, and many improvements must be made before it can come into general use. The weight of a "generator" which would supply thirty incandescent lamps would be two or three tons, and it would require a correspondingly large amount of fuel to operate it. It is not likely that the new discovery will supplant our present systems of obtaining power or electricity; but, as the inventor modestly claims, "its practical utility may very probably equal the interesting scientific principles which it embodies."

AN interesting and suggestive inquiry has recently been made by the editors of *Science*, in regard to the increase of "State interference," or regulation of industrial, mercantile, and professional affairs by the governments of the different States. The results of the inquiry are rather startling, and show that this objectionable policy has reached an extent which few persons realize, and that in some cases a near approach has been made to the practical adoption of socialistic principles. Minnesota, New Jersey, and Massachusetts make the worst showing in this respect; but it is only fair to say that this is probably due to the more complete reports obtained from those States. It is also very remarkable that the majority of the reporters — presumably persons of more than average intelligence — look upon this dangerous tendency with approval. While we have faith to believe that the adoption of the *laissez-faire*, or "non-interference" policy, in its most complete form, is only a matter of time, the results obtained by our contemporary are certainly rather discouraging, and would indicate that a long time must elapse before the people of this country will govern themselves on scientific and rational principles.

A NEW BASIS FOR CHEMISTRY.[1]

THE author of this work is well known as an opponent of the atomic theory; and the present work, which is practically a compilation of all that he has previously written on the constitution and transformations of chemical substances, presents, in a condensed form, the arguments in favor of a new theory of chemism which is certainly a very wide departure from the views most generally held.

Professor Hunt does not admit the existence of atoms as conceived by the chemist. He claims that a chemical combination is not caused by the juxtaposition of atoms or individual particles, but is a combination or integration of volumes as a whole. Thus, when one volume of hydrogen and one of chlorine unite to form one volume of hydrochloric acid, the result is not due to the closer approximation of the separate atoms, but that "the volumes uniting are lost in that of the product, there being an identification of volume. The converse is true of decomposition." He supposes liquid and solid bodies to be formed from their vapors by a chemical change analogous to that of polymerization: thus, water is not H_2O, the same as steam, but $1628H_2O$, which would make the combining number (molecular weight) of water 29,244.

Carrying out this idea, he says (p. 145): "By polymerization or homogeneous integration, the normal gaseous or volatile species are

[1] *A New Basis for Chemistry.* By Thomas Sterry Hunt, M.A., LL.D. 165 pp. Samuel E. Cassino, publisher, Boston, Mass. Price $2.00.

thus changed into liquids and solids of greater or less degrees of condensation. Of these the denser, other things being equal, are the harder and the more stable or indifferent to chemical changes such as fusion and solution. This relation has been illustrated at length by showing that hardness and fixity of native sulphides, oxides, carbonates, and silicates, and their resistance to the action of solvents, augment with the condensation of the species."

In the same way, solution, evaporation, and crystallization are considered to be true chemical processes, and referred, like other chemical changes, to the integration or disintegration of homogeneous or heterogeneous substances.

Speaking of the "genesis of the elements," he says (p. 143): "If, as we may suppose, all chemical species have come from one form of primal matter, it follows that the final disintegration of all so-called elementary species must be a homogeneous one, giving rise to that primal substance which can only be conjectured to be a species much more attenuated than hydrogen, and possibly identical with the matter giving the green line 1,474 of the corona, or some other unknown element."

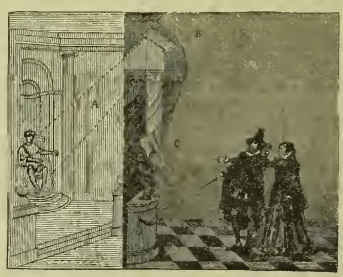
In thus giving a brief summary of the "new basis," we cannot do full justice to the subject, and have only presented the most prominent features of a very complicated theory, which to our mind is far from being as satisfactory as the atomic theory which it is intended to supplant. Few chemists will admit a belief in the actual existence of atoms; but by assuming these atoms they can not only explain all the observed chemical phenomena, but can predict the occurrence of phenomena before they are observed. It is an undisputed fact that the elements combine among themselves according to definite weights, and, in the case of gases, according to definite volumes as well; and a concept like that of atomic weights seems almost indispensable to explain the facts. The "atomic weights" *must* be the weight of *something*. It is difficult to believe in the actual existence of atoms, but it is, to our mind, much more difficult to believe in an "identification of volumes," for this, if we have understood Professor Hunt's theory rightly, would require us to believe, that, as in the case above cited, two volumes of hydrogen and chlorine can occupy the space of one, or, in other words, that two separate bodies can be made to occupy the same space at the same time. In fact, we cannot see how the term "polymer," which he uses to describe the condensed forms of chemical bodies, can have any significance except in connection with the atomic theory. If water is a compound body of 1,628 volumes of steam, what determines the weight or individuality of this unit volume of steam, of which the water-unit contains such a large number?

Again: those bodies usually known as polymers present many absolute chemical differences, utterly unlike those prevailing between the solid, liquid, and gaseous state of the same substance. Acetic acid ($C_2H_4O_2$) polymerized three times gives grape sugar ($C_6H_{12}O_6$), but these two bodies are absolutely unlike chemically. Neither can be easily transformed into the other, and there is no chemical relation between them. In the case of water and steam these two bodies are chemically identical, and can be changed into each other with the greatest ease. The change of steam into water is undoubtedly an instance of condensation; but we think the observed facts are hardly sufficient to warrant us in calling it a chemical condensation, and the term "polymerization" seems to us decidedly inappropriate.

These remarks are not intended as a criticism of Professor Hunt's theory, but merely as a discussion and comparison of the old with the new "basis." A true and absolute system of chemical philosophy is yet to be constructed, and all our theories are but as the scaffolding around the uncompleted building. As yet the old one has well supported the workmen; and although, if it proves faulty, we should be glad to see it replaced by a better one, we do not yet believe that it has outlasted its usefulness, or that we are more likely to gain a clearer knowledge of the constitution of matter by the aid of the theory so ably worked out and presented by the distinguished author of this work.

A MAGIC MIRROR.

The astrologer Nostradamus, who flourished about 1550, had a great reputation as a magician and conjurer of evil spirits, although in this less superstitious age he would have been considered simply as a student of science.



The magical powers with which he was credited were doubtless due to his knowledge of physics and chemistry; and on more than one occasion, when the French cities were devastated by pestilence, his medical skill was of the greatest benefit to the inhabitants.

He was especially celebrated as the possessor of a magic mirror in which past events and prophesies of the future were made to appear to those who consulted it. It is said that Catherine de Médicis, while at the city of Blois, was shown the images of a line of French kings followed by a crowd of Jesuit priests, struggling among themselves for the possession of the crown of France, which was, doubtless, very impressive and edifying to the credulous lady, although the method by which it was probably accomplished was so simple, that it would seem as if, even in those days, it would have been discovered at once.

The experiment is a very entertaining one, and, as some of our readers may like to repeat it for the amusement of their friends, the accompanying engraving will show the arrangement of mirrors, etc., necessary to produce the illusion. The mirror in which the image appears, *C*, is inclined at such an angle, that a person looking into it sees not his own reflection, but that of a second mirror suspended overhead and concealed by a canopy. In this mirror is reflected the image of a person or object concealed behind a partition or screen, in the upper part of which is an opening just large enough to allow the light to pass through. So, instead of beholding a vision of spirits, Catherine de Médicis was simply looking into an adjoining apartment by the aid of the "magic mirror" of Nostradamus.

In repeating the experiment, a doorway between two adjoining rooms can be utilized, by draping it with curtains so as to leave an opening near the top. Both this opening and the mirror *B*, which should be considerably larger than *C*, must be concealed by a canopy, as in the illustration. When every thing is in readiness, the lights should be turned up in the room behind the curtains, while the room in which the spectators are should be partially darkened. Each must advance in turn to the proper position to observe the reflection, and the "magician" must take care that they do not approach near enough to the mirror to detect the trick. In this way any desired number of "spectres" may be exhibited in a more satisfactory manner even, than was accomplished by the old mediæval necromancer.

[Specially reported for the *Popular Science News* from the Observatory of the College of New Jersey.]

ASTRONOMICAL PHENOMENA FOR OCTOBER, 1887.

Mercury reaches its greatest eastern elongation, 24°, on Oct. 26; but, as it is at the same time about 10° south of the Sun, it will hardly be possible to see it. Venus passed inferior conjunction on Sept. 20, and is rapidly increasing its apparent distance from the Sun, rising about an hour before sunrise on Oct. 1, and three hours before on Oct. 31. It will be very bright, and easily seen by daylight during the month; its greatest brilliancy coming on Oct. 28. Mars is a morning star, gradually growing brighter, but still only one-twelfth as brilliant as it will be at the next opposition. By the end of the month it rises between 1 and 2 A.M. On Oct. 10 it approaches very near to the first-magnitude star Regulus (*Alpha* Leonis), the planet passing about 1° north of the star. There is also a near approach to the Moon on the morning of Oct. 13. For dwellers in the tropics and south temperate zone the planet will actually be occulted by the Moon. Jupiter is rapidly approaching conjunction with the Sun, and will not be in a good position for observation during the month. On Oct. 25 it is only about 34′ from the second-

magnitude star *Alpha* Libræ. Saturn rises about 1 A.M. on Oct. 1, and is in quadrature on Oct. 29. During the month it will move about 2° eastward, and may be found east and south of Castor and Pollux, about 15° from the nearer one. Uranus is in conjunction with the Sun on Oct. 6, and will be too near that body to be seen during the month. Neptune is south and a little east of the Pleiades. The first-magnitude star Aldebaran (*Alpha* Tauri) will be occulted by the Moon on Oct. 6; but, as the occultation will occur about 9 A.M., it will not be possible to see it without a good telescope. M.

[Specially reported for the *Popular Science News.*]

METEOROLOGY FOR AUGUST, 1887, WITH REVIEW OF THE PAST SUMMER.

TEMPERATURE.

Average Thermometer.		Lowest.	Highest.	Range.
At 7 A.M.	61.90°	52°	75°	23°
At 2 P.M.	73.58°	62°	83°	21°
At 9 P.M.	63.20°	52°	72°	20°
Whole month	66.23°	52°	83°	31°
Second average	65.47°	52°	83°	31°
Last seventeen Augusts	69.04°	65.83°, in 1874.	71.76°, in 1872.	5 93°
Second average	68.35°	65.17°	70.99°	5.82°
Summer of 1887	69.01°	49°	92°	43°
Last seventeen summers,	69.08°	67.19°, in 1881.	71.67°, in 1876.	4.48°

The present August has been the coolest, with a single exception (1874), in seventeen years, and yet followed the hottest month, without an exception, during this period. The warmest day of the month averaged 74⅝°, on the 1st; the coolest 56⅜°, on the 31st. The warmest three days averaged 74⅛°, occurring on the 1st, 6th, and 12th; the coolest three 58°, on the 31st, 30th, and 28th. The highest point reached at the hour of observation was 83°, on the 12th; the lowest 52°, on the 28th and 31st. The entire month was 2.81° below the average. The mercury reached 80° on only six days during the month. The closing week of the month was remarkably cool and fine for August, and the entire month was unusually free from damp, sultry "dog-day weather;" that came this year chiefly in July.

SKY.

The face of the sky in 93 observations gave 51 fair, 18 cloudy, 18 overcast, and 6 rainy, — a percentage of 51.8 fair. The average fair in August for seventeen years has been 63.3, with extremes of 50.5 and 86. The cloudiness of August has exceeded the present but three times in seventeen years. The morning of the 24th was foggy.

RAIN.

The amount of raiufall the past month was 3 38 inches, while the average in nineteen Augusts has been 3.92, with extremes of 0 48, in 1883, and 10 03, in 1872. We fell short of the average more than half an inch, while some other parts of New England were visited with damaging floods. The rain fell here in quite moderate quantities on seven different days, well distributed through the month, though none fell during the last week. Thunder and lightning occurred on the 2d, 11th, 20th, and 23d, but with no severity in this locality. The amount of precipitation since Jan. 1 has been 34.45 inches, while the average in nineteen years has been only 31.38 for the same months.

PRESSURE.

The average barometer the last month was 29 962 inches, with extremes of 29.70, on the 18th, and 30 23, on the 31st, — a range of .53 inch. The average pressure of August for the last fourteen years has been 29.962, with extremes of 29 868, in 1878, and 30 029, in 1884. August has reached an average of 30 inches and upwards twice in the last fourteen years. The sum of the daily variations the past month was 3.27 inches, an average daily movement of .106 inch. This average in fourteen Augusts has been .087, with extremes of .051 and .125. The largest daily movements were .26, .22, and .20, in connection with rainfall.

WINDS.

The direction of the wind in 93 observations gave 11 N, 2 S., 7 E., 24 W., 8 N E., 27 N W., 3 S E., and 11 S.W., — an excess of 30 northerly and 44 westerly over the southerly and easterly, and indicating the approximate average direction to have been W. 34° 17′ N. This is the third time in eighteen years that the northerly winds in August have prevailed over the southerly, and is doubtless one cause for so cool a month; but why the northerly winds have so unusually prevailed is more difficult to explain. The westerly winds have prevailed over the easterly, with two exceptions (2 in 1873, and 20 in 1875), by an average of 32 06 observations, and the southerly over the northerly, with three exceptions (10 in 1873, 15 in 1885, and 30 in 1887), by an average of 11.89; indicating the general approximate average direction for August in eighteen years to have been W. 20° 21′ S. The longitudinal extremes in this period have been 20 E. and 75 W., — a wide range of 95 observations; and the latitudinal 30 N. and 45 S., — a range of 75. The relative progressive distance travelled by the wind the past month was 53.26 units, and during the last eighteen Augusts 615 such units, — an average of 34.19; showing less opposing winds the past month than usual for August.

REVIEW OF THE SUMMER.

The temperature of the summer months was a very near average of the last seventeen years, as seen by the above table. The extreme heat of the last July was nearly balanced by the coolness of August. The extreme summers are also noted in the table.

The face of the sky the past summer was just 50 per cent fair, while that of the last seventeen has been 61.9 per cent fair; showing the present to have been nearly 12 per cent less fair than usual.

The amount of rainfall the past summer was 8.88 inches, while the average for the last nineteen has been 9 80, with extremes of 4.39, in 1883, and 18.13, in 1872.

The average pressure the past summer was 29 985 inches, while the average for the last fourteen has been 29.938, a small fraction below that of the present.

The direction of the winds the present summer has been very nearly due west, while the average for the last eighteen summers has been W. 24° 22′ S. more than two points more southerly than the present.

D. W.

Natick, *Sept.* 5, 1887.

QUESTIONS AND ANSWERS.

Letters of inquiry should enclose a two-cent stamp, as well as the name and address of the writer, which will not be published.

Questions regarding the treatment of diseases cannot be answered in this column.

B. S. G., *Elmira.* — It is probable that gold was the first metal discovered by man, as it is one of the few which occur in the native or metallic state, while iron, copper, tin, and other metals usually require to be reduced from their ores. The first indications of metal among the prehistoric inhabitants of Western Europe, however, are weapons and implements of bronze, which must have required considerable skill to manufacture.

H. T. C., *Newport.* — I often find in ice-cream hard lumps resembling salt, but which cannot be that substance. Of what are they composed?

Answer. — They are simply crystals of ice, and are due to the imperfect agitation of the cream while freezing. In all processes of crystallization the tendency is to eliminate impurities; and, unless the cream is kept well stirred, the water will freeze by itself, without retaining the solid ingredients.

Will F. B. of Boston, who wrote for information concerning "compound oxygen," send his address to this office?

J. M., *Maryland.* — Water at the freezing-point will absorb 1,148 times its volume of ammonia gas, at ordinary temperatures about 700 times its volume, but at the boiling-point will not absorb any at all except under increased pressure. A red heat is necessary to disassociate its elements.

LITERARY NOTES.

Food Adulteration and its Detection. By Jesse P. Battershall, Ph.D., F.C.S. E. & F. N. Spon, publishers, New York. Price $3.50.

Chemists, physicians, health officers, and all persons interested in the purity of food and drink, will find this work of the greatest value and interest. The author's position as Government Chemist has afforded him special opportunities to observe forms of falsification which do not ordinarily come to the notice of the general analyst. A very important and valuable feature of this book is the incorporation of photogravures or artotypes (executed by Mr. Edward Bierstadt), the majority of which represent the results of microscopical research. By means of these plates one is enabled to have in his possession actual photographic reproductions of the substances represented, which possess far greater value than the best executed wood or stone cuts possibly could. One of the most important advantages of this work is, that it includes the very latest investigations and analytical methods. Oleomargarine and butter substitutes, for instance, have only recently assumed any importance, and are scarcely mentioned in earlier works, but are here treated of in a most thorough manner. In general, the results obtained by Dr. Battershall confirm the opinion often expressed in these columns, — that adulteration of food is not nearly so extensive as is commonly supposed, and rarely consists in the addition of injurious or poisonous substances.

The Abstract of the Proceedings of the Society of Arts for 1886 and 1887 is issued by the Massachusetts Institute of Technology, and contains numerous interesting and valuable papers upon scientific, technological, and industrial subjects.

A. Lovell & Co. of New York have published *Greater America; or, Hits and Hints by a Foreign Resident.* Price 50 cents. While the "foreign resident" is evidently a close and intelligent observer of our political and social institutions, like most of his class he fails to thoroughly understand them; and, although his ideas are worthy of perusal, there is little of value, or even of novelty, among them.

Alatypes or Steno-typography is a new and condensed alphabet of written and printed characters. It is, in effect, an improved system of shorthand adapted to every-day use. The system was devised by the late Henry H. Brown of Battle Creek, Mich., and the book will be sent to any address on receipt of four cents in stamps, by F. W. Dunning of the same city.

The Climatologist is the title of a new quarterly journal about to be issued by Mr. George H. Rohé of Baltimore, Md., at the moderate price of 50 cents per year. It will be devoted to the scientific and practical consideration of questions in the domain of medical and sanitary climatology, including climato-therapy, preventive medicine, and the investigation of the merits of mineral springs and health resorts. Many eminent climatologists and sanitarians have consented to act as collaborators.

Pamphlets, etc., received: *Brother against Brother*, a story of the Rebellion, J. S. Ogilvie & Co., New York (price 25 cents); *Plant Analysis as an Applied Science*, and *Plant Chemistry as Illustrated in the Production of Sugar from Sorghum*, by Helen C. De S. Abbott; *Arrow Release among the Navajos*, and *Individual Variations in the Skeletons of Birds*, by Dr. R. W. Shufeldt; *A Review of Surgery, Medicine, and Pharmacy for the Last Forty Years*, by C. W. Moore, M.D.; *Reports of the Agricultural Experiment Stations of Massachusetts, Georgia, and Ohio*; and the *Catalogues of the New York City Eclectic Medical College, and the Medical Faculty of McGill University.*

Medicine and Pharmacy.

[Original in *Popular Science News.*]

A NEW CAUSE OF DEATH BY DROWNING.

BY EDWARD P. ROCHE, M.D.

The city of Bath is nearly surrounded by water, — the Androscoggin and Kennebec Rivers on the north, the sea in the form of creeks and inlets on the south. The ice forms in the rivers about December, and goes out in April. The population is largely made up of people familiar with the water. My profession brings me in contact with all classes of the population; and I am, for some ten years past, accustomed to bathe in these waters from the last of April to the last of November. These opportunities and experiences, I believe, fit me to express an opinion as to some of the causes of death by drowning.

A careful analysis and examination of cases and bodies dead from short or long immersion under water, fully warrants me in asserting that cramp is not a cause of death in drowning. I have sought in vain for evidence of a body showing signs of cramp in the death-struggle, no matter how soon it was rescued from the water. I am familiar with the appearance of bodies killed instantly while under great effort, as in the dead of the infantry charges during our last war.

Dismissing cramp, and introducing three typical cases, I believe a new cause of death by drowning will be admitted.

A. A small trader crossing a wide river in November, the thermometer at zero, was seen by the steersman to disappear over the chain drawn across the end of the boat. The boat was a side-wheel, and must have passed over the man. With great difficulty, amidst new-made ice, in some four to six minutes' time he was rescued. He made no outcry in going over, and, after the boat passed over him, rose to the surface and remained there, throwing his arms wildly about, but aimlessly as to the direction of the boat, and without outcry of any kind. The extreme end of the boat was of a rounded form, and extended some two feet beyond the chain over which he fell: the chain hung about two feet and a half above the deck. The man died from the accident. He was found to be heavily insured. The insurance companies demurred payment, on the ground of suicide; making strong claims of fraud, because the man had made no outcry or call for aid while in the water, and, if any thing, swam away from the boat, in place of towards it. As attendant and expert, I was called for the defence, but believe the statement presented satisfied the companies, and the widow received — justly — the amount of the insurance.

B. On a warm, clear summer afternoon, at a watering-place known as Wells' Beach, with summer guests and relatives or friends walking in close proximity, and watching the bathers in the very gradually deepening water, a healthy, strong, more than commonly good swimmer suddenly began to act strangely, throwing his arms wildly about, apparently making great effort, but no outcry. The onlookers deemed the action sport; but when the young man sank beneath the shallow water, and failed to return to the surface, the scene changed, but too late. In water that a tall man could almost stand in, a young, vigorous, and courageous youth had drowned, in the very sight of his friends, without a single outcry.

This case is briefly told, but correct in particulars as reported to me at the time.

I have carefully studied this case in connection with a parallel one that occurred on the Pacific coast, and unhesitatingly pronounce it an exact counterpart and answer as to the mode of the banker Ralston's death in the Bay of San Francisco. As an expert on oath, I would feel bound to deny the insinuation of suicide in his case.

C. On a warm July noon two boys, aged respectively sixteen, undressed beside a pond to bathe. Both could swim fairly, and were familiar with the spot. One, whose attention for a moment was called to the bushes that fringed the shore, on turning missed his companion. Running a few feet to the shore, he saw him on the bottom, in less than six feet of water. An alarm was quickly given, the body rescued; but too late. The family physician declared the cause of death to be from going into the water with the blood heated, as though the blood could be heated or cooled like a metal. The duration in time of the whole action could not have been more than a minute. The companion was at no time beyond a few yards from the spot, yet heard no outcry or splash of the water. So far as could be known, the drowned boy made no effort to rise, but sank to the bottom, and remained there.

In my own mind I was satisfied of the cause of death in all these cases; but they remained among my notes for over five years, before I found a demonstration, with proofs, that I could make plain and public.

One bathing-place selected for a series of experiments in floating was a cove in which the tide rose some six feet; into this was built a pier of logs, cob-fashion, and filled in with earth. The pier rose but two feet above high water, was a good spot to jump from, and the knots on the sides served as points to draw one's self out by.

Shortly before or after high water, by standing erect, I could just touch the bottom with my toes and keep my nostrils above the surface.

Under these conditions, at this spot, I found myself eighteen feet from the shore, — a sloping, slippery, rocky one, — and the same distance from the side of the log cob-work. The tide was up, so that, by straightening myself on my toes, I could just clear my closed mouth from the surface of the water. While in this position, a ripple made by the plashing of a fish-pole in the hands of a small boy on the pier, broke against my upper lip, and in an instant, without the slightest warning, I found myself speechless and struggling for my life, as I never have before nor since.

After what seemed a long period of indecision as to shore or pier being the nearer, I swam for the pier, and just succeeded in dragging myself upon the top log, and fell over on the ground, face down, my feet in the water. I could make no sound of any kind; my chest and diaphragm were immovable, and felt like an iron tube with an iron bottom. The veins in my neck did not feel prominent. I could use all my limbs, but they were very heavy, with a strange feeling in them of immense size, and a mental idea that I could not move them, on account of their size and weight. The body and head appeared the same as to size. The heart, instead of beating or throbbing, was whirring.

Just after the attack in the water, there was a strong disposition to cease effort, and sink face downwards, or if on land to fall forwards.

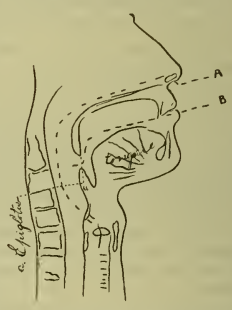
I estimated the whole attack to have lasted twelve minutes before I felt collected and strong enough to walk and talk. The ability to make a vocal sound returned in about four minutes; to form words that could be heard above a whispering tone, some two to four minutes later.

From my condition on reaching the pier, I estimated the limit of endurance of a cool-headed man, used to emergencies, under the same conditions as mine, to be the power to swim from twenty to forty feet before the body would sink from lack of buoyancy and intelligent effort.

At the instant of attack I raised my hands from the water to my face and neck, in an instinctive, aimless effort similar to what I have noticed in children dying of croup. The boys on the pier said I did not at once swim for the pier, but threw my arms about and splashed the water, and then struck out for the pier. They thought I was "fooling."

Now, what I *know* happened, and what has remained unthought of or discovered, to baffle medical experts and juries in those unaccountable cases of death by drowning, especially of those known to be good swimmers, or business-men whose affairs are found to be involved, was this: The top, or spray, of the ripple that broke against my upper lip was inhaled through the nostrils, and, passing in the air-current to the pharynx, was drawn into the trachea, or windpipe. It passed *behind* the epiglottis, thus eluding the acutely sensitive guard established by nature for the protection of the individual, and the result was instant spasm of the whole respiratory organism, — an accident rare and serious under the most favorable circumstances, but to a person alone in the water, terribly so. In order to designate this from other accidents of the larynx, I term it swimmer's spasm of the larynx.

The diagram in vertical sections of the human throat, taken from *Gray's Anatomy*, p. 746, shows clearly how this accident occurs. The dotted line *A* shows the route of the air and spray from the nostril, over the palate, down the pharynx, and into the larynx and trachea; the epiglottis being entirely eluded, unless some portion of the spray touch it or the side of the larynx in time to prevent its entrance.



Following the line *B*, it can be seen how almost impossible it is to elude the epiglottis and pass into the larynx. At best a liquid can only trickle over its edge, and cause a form of strangling so well known to bathers who "swallow water."

In the case *A* the following I believe to be the facts: The man slipped, and in falling over the chain, in order to protect himself from injury in striking upon the iron-shod portion of the deck that projected some two and a half feet beyond the chain, had no time to cry out, but exhausted the amount of air in his lungs in the effort, and at the close of the next inspiration met the spray from his splash into the water, inhaled some of it, and had the spasm of the larynx with the lungs *full*. A suicide would have chosen the rear end of the boat, where he could drop into the water unseen. A man thickly clad in dry woollens, with the lungs completely full and spasmodically closed, would float a reasonable time, and would be to a great degree incapable of making any outcry or intelligent effort to assist himself or rescuers.

The case of *B* was similar to my own and Ralston's. A ripple broke into spray in front of the nostrils; a portion of the spray was inhaled, carried into the windpipe, and produced an instant spasm of the larynx. It *probably* occurred about midway of the inspiration, leaving some air and oxygen for action in the lungs.

In the case of *C* the boy drew a long breath and slid into the water *expiring*, met the spray at the very commencement of his next *inspiration*, and inhaled some of it; the spasm of his larynx oc-

curred at the commencement of the inspiration, when the lungs were entirely empty. A growing boy, with no more air in the abdomen than usual to his age, he sank at once.

In *A* the lungs were full, hence he floated and struggled some six minutes, until rescued; in *B* the lungs were probably not more than half inflated, and the final struggle was shorter than in the case of *A;* while in *C* there was no air of any amount in the lungs, and his body immediately obeyed the law of gravity. Had the spasm of the larynx occurred to the boy at his home, undoubtedly he would have fallen to the floor speechless, and been pronounced in a fit. It should be noted, this accident and article do not refer to cases of drowning after great exposure or prolonged effort, but rather to those heretofore classified as due to cramps, fits, heart-disease, etc.

Bath, Me., *Aug.* 15.

[Specially reported for the *Popular Science News.*]

THE NINTH INTERNATIONAL MEDICAL CONGRESS.

The ninth in the series of international medical congresses is now a thing of the past. The first, an outgrowth of the French Medical Congress in 1865, was held during the French Exposition in Paris in 1867, with an attendance of 1,200. The second was held in 1869 at Florence, with an attendance of 357. The third occurred during the great exhibition at Vienna in 1873, when 671 were present. The fourth met at Brussels in 1875, when 412 were there. The fifth, at Geneva in 1877, was attended by only 365. At the sixth, in Amsterdam in 1879, the attendance rose to 630. The seventh, the most brilliant and interesting, was held in London in 1881, and attracted 3,181 members. The eighth was held in Copenhagen in 1874, and the attendance reached 1,350.

The ninth was thus the first to be held on this side of the Atlantic, and met in Washington from the 3d of September until the 10th. There was an unfortunate division among the American physicians in regard to the management of the affair, which prevented it being a representative American body. The leading men of New England and New York were very scarce, and only a portion of the Philadelphia physicians were represented. The attendance was nevertheless large, nearly 2,500, which included probably 150 foreigners. Among the latter were a few men of mark: Dr. Leon Le Fort of Paris, in charge of the *Hôpital Necker;* Dr. Grailly T. Hewitt, an eminent gynecologist of England; Dr. P. G. Unna of Hamburg, editor of the *Journal of Dermatology;* Dr. Mariano Semmola of Naples, a scientist and senator in the Italian Parliament; Dr. A. Martin of Berlin, an eminent obstetrician; Dr. Apostoli of Italy; Dr. William H. Pavy, an English authority upon dietetics; Dr. J. A. S. Grant of Cairo, Egypt, who wore a red fez and the title of Grant Bey; and Dr. Joseph Korosi, a medical statistician of Buda-Pesth, Hungary. Ireland, London, Denmark, Turkey, Brazil, Scotland, and Canada were also represented.

The congress was called to order in the presence of a large number of spectators at 11 A.M., Monday, in Albaugh's Opera House, a very handsome and commodious place of assemblage; and President Cleveland, in a few words, but in a dignified manner, formally declared the session open. The officers of the congress were then elected, of whom the most important are as follows: President, Dr. Nathan S. Davis of Chicago, editor of the *Journal of the American Medical Association;* Secretary-General, Dr. John B. Hamilton, supervising surgeon-general of the U.S. Marine Hospital Service; Treasurer, Dr. E. S. F. Arnold of Newport, R.I. There was also a list of eighty vice-presidents, besides a president, secretaries, and councillors for each of the eighteen sections into which the congress was divided. Secretary Bayard of the State Department then made an excellent address of welcome, to which representatives of England, France, Italy, Germany, and Russia made appropriate replies. President Davis then delivered an address of some length, which closed the inaugural exercises.

The whole congress met each morning in the Opera House, while the rest of the day was occupied with the meetings of the sections into which the body was divided for convenience of work, and which embraced the whole range of medicine. It was the intention to occupy each morning hour with two papers from men of eminence, but the failure of some of the essayists to put in an appearance altered the programme, and but one paper was read before the general session each day. Monday was devoted to the opening exercises. On Tuesday Dr. Austin Flint of New York, a well-known writer on physiology, delivered an address upon "Fever: its Causes, Mechanism, and Rational Treatment." Wednesday morning's session was occupied by Dr. Mariano Semmola of Naples, Italy, with a paper upon "Bacteriology and its Therapeutical Relations." On Thursday Dr. P. G. Unna of Hamburg, Germany, spoke upon "The Relations of Dermatology to General Medicine." The last paper of the general session was delivered on Friday by Dr. G. Fielding Blandford of London upon "The Treatment of Recent Cases of Insanity in Asylums and in Private Houses."

There were over six hundred papers on the lists of the various sections; but, as usual in such gatherings, the most of them were not read. The interest in the meetings of the sections, which were held in halls, churches, etc., as near as might be to the place of the general meeting, varied with the nature of the subject and the eminence of the speakers. Some of them were well and some poorly attended. The papers were mostly upon technical subjects, and but few of them were of interest to the general public.

Monday evening there was a *conversazione* (or promenade concert) in the new United States Pension Hall, which was very handsomely decorated for the occasion. There were twice as many people present as there were members of the congress in the city, which might be presumed to be indicative of the interest taken by citizens of Washington in the congress, or of that enterprising spirit which leads the public to crowd in where it can get a chance. There were no formal exercises, the meeting being held purely for purposes of sociability.

Tuesday evening the members of the congress were received at the White House by the President and Mrs. Cleveland. At eight o'clock, the hour announced for the reception to begin, there was a double line, reaching from the door out through the grounds and down Pennsylvania Avenue. The whole lower floor was thrown open to the visitors; and the East Room, which had been especially decorated for the reception with flowers and potted plants, as on a state occasion, made a very handsome appearance. The President and his wife shook hands with all who came, from eight o'clock till eleven, and must have breathed a sigh of relief when it was over. It is supposed that a lot of Washington people must have taken advantage of this occasion also. The reception was an informal one, and there was little or no attempt at dress.

Wednesday evening was given up to various private receptions by citizens of Washington. Thursday evening occurred a reception at the United States Pension Hall, from which all but members of the congress were carefully excluded. There was a large crowd; the hall was very beautifully decorated, and the thousands of people present promenaded to the music of the Marine Band. There was a stand-up lunch, which occasioned in the early part of the evening a promiscuous scramble for food; but there was abundance of it, and American champagne was offered without limit. The menu was a handsome souvenir.

The weather was delightful, though there was now and then a little more heat than perfection would demand. The city of Washington, beautiful, spacious, and attractive for many reasons, made an admirable place of meeting. It was an unfortunate time of the year, however, as the national Congress was not in session, there was no suggestion of the brilliant social life of the capital, and the streets were deserted of the greater part of its hospitable citizens. However, there were the social entertainments above referred to, and other arrangements were made for the pleasure of the visitors. Secretary Whitney held a reception for the foreign guests at his country seat; they were taken to see Mount Vernon; and, at the close of the congress, an excursion was arranged to take them to Niagara Falls. The members of the congress were invited also to various public institutions, the Corcoran Art Gallery was made free to them the evening of the President's reception, and the Secretary of the Treasury opened the government vaults for them to see and envy. It is safe to conclude, that, if the members of the congress failed to find interest in their own proceedings, the monuments, parks, and buildings of the city afforded them ample means of enjoyment, so that they did not have much occasion to lament the dulness of the season.

So large an affair does not go off without friction, as a rule. It appeared, in this case, on the opening day. It happened that Dr. Francesco Durante, the accredited representative of the Italian government to the congress, had naturally been invited to respond for his countrymen to the address of welcome, and accepted. When he came to make inquiries, however, he learned that he had been set aside, and that Dr. Semmola, a fellow-countryman, had insisted, that, as an Italian senator, it was his place to say the polite thing for Italy, and that, if his claim was not recognized, he would leave. As the committee depended on him for one of the main addresses during the week, they had to give in to him, and drop Durante. The latter at once withdrew from the congress, insulted; but his wounded feelings were soothed by apologies, and he and Semmola had a dramatic scene of reconciliation in public the next day.

It is said that a prominent medical chemist across the ocean wrote to the Committee of Arrangements that he had no doubt music would lend a charm to the occasion, and that he and his daughter would be happy to come over, and the latter would sing for five hundred guineas. They did not register if they came.

The city was fairly given up to the doctors. They swarmed everywhere, conspicuous by their big medals and blue or red ribbons, emblems of their congressional membership. The bootblacks and newsboys, the clerks and porters, called all strangers "Doctor," as a matter of course. The hotels overflowed with them. The American members would have, no doubt, been glad to repay in kind the abundant hospitality of London; and the occurrences which prevented united American effort, and therefore stood in the way of a brilliant and completely successful affair, are much to be regretted. The next congress will meet in 1890 at Berlin.

[Specially compiled for the *Popular Science News.*]

MONTHLY SUMMARY OF MEDICAL PROGRESS.

BY W. S. WELLS, M.D.

DR. ORD read a paper at the last annual meeting of the British Medical Association on some of the rare symptoms produced by gall-stones. Attention was first called to the circumstauce that gall-stones may exist without producing symptoms, as shown by the number frequently found post-mortem in cases in which their presence during life had not been suspected.

Gall-stones may be passed without accompanying jaundice, but usually give rise to pain and vomiting. The case of a woman is reported who had no previous signs of gall-stone, and who, the day after her confinement, passed a gall-stone of such an enormous size that its passage was attended with almost as great difficulty as a second labor, and it was hence dubbed "the twin." A case is related of a woman subject to irregularly recurring attacks of pain in the region of the gall-bladder, with associated vomiting and faintness, but who never had jaundice nor passed pale stools. Many physicians examined her, but no one formed a correct diagnosis, and the patient died from perforatiou of the stone through the gall-bladder into the peritonæum.

Gall-stones may produce intermitting pyrexia, as shown in the case of an Indian medical officer, who, after his return to England, was attacked with paroxysms of shivering, followed by fever, and sweating at regular weekly periods. Dr. Ord had a case of glycosuria due to a gall-stone, which disappeared, together with the concomitant symptoms of thirst and emaciation, ou the passage of the stoue. In another case an attack of pneumonia developed in the subject of biliary calculus, being evidently in some obscure way dependent upon the calculus.

The co-existence of gall-stone with malignant disease of the gall-bladder and contiguous parts has been noted. Cases have been observed, also, in which the passage of gall-stones was attended with decided hemorrhage; in one the hemorrhage preceded the passage of a large gall-stone, without biliary obstruction having been at any time indicated.

FOLLOWING the subject of epistaxis from a former article, the *Record* gives some points regarding this symptom in its prognostic aspect.

Epistaxis, persistent after a blow or fall upon the head, is of evil prognostic import, as it usually indicates fracture of the base of the skull. Occurring at the beginning of an eruptive fever, nosebleed should cause no alarm; but when it comes on during or after the period of eruption, it is of graver import, as it is theu usually an indication of malignancy or of hemorrhagic tendency in the disease. When it occurs often in whooping-cough, it is a bad sign, indicating that convalescence will be slow, by reason of the anæmia induced by such losses of blood.

In typhoid-fever, epistaxis occurring at the beginning of the disease is of rather favorable prognostic import, or at least not of evil; but when it appears late in the course of the disease, it is a grave sign, indicating profound changes in the blood, often followed by dangerous intestinal hemorrhages. In diphtheria, nosebleed is also unfavorable, indicating that the local disease-process is spreading and invading the mucous membrane of the nasal cavities.

In the later stages of Bright's disease, repeated attacks of epistaxis are of evil import, and may frequently be regarded as evidence that the coats of the arteries have undergone atheromatous changes, or softening by fatty degeneration. (In this sense may also be classed fatty degeneration of the liver, and possibly of other viscera, superinduced by excessive indulgence of alcoholic drinks.) In malarial cachexia the frequent recurrence of nosebleed is an unfavorable symptom. On the contrary, epistaxis is frequently of benefit in relieving cerebral congestion and preventing apoplexy. A case is reported by Dr. Erwin, of Bay City, Mich , in which hypertrophy of the tonsils was associated with epistaxis, and immediate cessation of the nosebleed followed excision of one tonsil.

DR. SENN writes from London that a new operation, osteotomy of the pelvis, is proposed by Macewen, whose experiments have demonstrated that section of the pubic bone an inch and a half or two inches from the symphysis, and of the ascending ramus of the ischium, would add one and a half inch to the antero-posterior diameter of the pelvis. By such an operation, in cases of difficult labor from contracted pelvis, Macewen proposes to do away with the much more serious operation of abdominal section.

M. BLONDEL proposes, in the *Gaz. des Hôpitaux*, the employment of albuminate of iron in certain cases of dyspepsia associated with anæmia. The combination of iron and albumen seems well suited to correct the alteration of the blood which is characterized by a decrease in quantity of its albumen. M. Blondel administers this medicament in the form of *liqueur de Laparade*, in which the sirup of orange, itself useful in relieving atony of the atomach, is the vehicle in which the albuminate of iron is mixed. The dose is one tablespoonful (containing five centigrams of the metal) after each meal.

THE *Gaz. des Hôpitaux* also publishes a communication from Dr. Sollaud, of the French navy, on the beneficial effects of a sulphurous atmosphere in pulmonary phthisis. The test was made upon a sergeant having pronounced symptoms of this disease, to whom was intrusted the fumigation of the rooms of two large barracks occupied by marine infantry. Part of the operation consisted in burning large quantities of sulphur in each of the dormitories, all orifices being hermetically closed. After thirty-six hours the sergeant with a couple of soldiers proceeded to open the doors and windows, which had to be done rapidly, for the air within was thoroughly saturated with sulphurous fumes. At first the fumes caused much distress and aggravation of the cough, with a burning sensation down the throat and windpipe; but, on persevering, the painful symptoms gradually disappeared, and the sergeant was able to move about, without inconvenience, in the densest sulphurous atmosphere, and soon derived great benefit, with amelioration of all the symptoms.

IN the *Bulletin Général de Thérap.* Dr. Bérenger-Féraud reports a remarkable case. A man twenty-six years old had received a stab-wound in the *left* temple some nine months before presenting himself at the hospital. He was sent to the hospital by some physician who had diagnosed the case as one of lachrymal tumor of the *right* side. Examination in this region showed the presence of what was supposed to be a small foreign body. The man was anæsthetized, and a broken knife-blade two and three-fourths inches long by five-eighths inch wide was extracted. The blade had traversed the left orbit without wounding the eye, muscles, artery, or nerve, had crossed the nasal fosse, and entered the right orbit, and had produced no symptoms denoting its presence.

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SETH C. BASSETT,

MANAGER.

Publishers' Column.

THOSE who have used the IMPERIAL GRANUM speak of it in the highest terms, and we urge our readers to give it a trial. See the eighth page.

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A. D. WILLIAMS, M.D., St. Louis, Mo.

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CONTENTS.

FAMILIAR SCIENCE. — What of the Potato? 155
Simple Scientific Experiments 155
Recent Archæological Discoveries 156
The British Association at Manchester 156
Volapük, the World-Language 158
Scientific Brevities 158

PRACTICAL CHEMISTRY AND THE ARTS. — Photograph of a Lightning-Flash 159
Crown Glass 159
Tempering Steel with Electricity 159
A New Method of Cleaning Stonework 159
Practical Receipes 159
Laboratory Notes 160
Industrial Memoranda 160

HOME, FARM, AND GARDEN. — The Mysteries of Plant-Growth 160
The Origin of the Peach 161
Ambrette 162
Hints for Winter Gardens 162

EDITORIAL. — Dr. Roscoe's Inaugural Address 163
Who should Study Chemistry 164
Astronomical Phenomena for November, 1887 164
Meteorology for September, 1887 165
Questions and Answers 165
Literary Notes 165

MEDICINE AND PHARMACY. — Sanitary Science and Domestic Architecture 166
Monthly Summary of Medical Progress 166
Acne Punctata and Kindred Affections 167
Chloroforming Persons while Asleep 167
Medical Memoranda 168
Humors 168

PUBLISHERS' COLUMN 168

Familiar Science.

WHAT OF THE POTATO?

BY THE SENIOR EDITOR.

THE potato as a natural vegetable product is a monstrosity. It is simply a mass of starch granules grouped together in grotesque and irregular ways, so that protuberances of greater or less size, puffed up into singular forms, make up the structure. The potato viewed as an article of food has few nutrient principles to recommend it, but as a table luxury it is highly esteemed in all lands where it has been introduced. What is more appetizing than a healthy potato just from the hot oven, with the pleasant aroma rising with the liberated steam as the outer covering is removed, and with crumbling, snowy-white starch granules falling upon the plate at the breakfast table? But nature never intended that it should subserve a higher purpose in human alimentation than one which is strictly secondary. The high purpose of foods is two-fold: first, to maintain animal warmth; second, to supply the needed amount of energy which every-day labor demands. The waste of the body which is constantly occurring, sleeping or waking, must be met by a supply of food which contains the chemical principles fitted to replenish and sustain the body. The element nitrogen is the important agent in foods which supplies force or energy, and this the potato holds only in insignificant quantities. It is capable of supplying warmth to a considerable extent, but it cannot be regarded as a carbonaceous food of high value.

The only people in the world who have fallen into the grievous error of striving to subsist almost entirely upon potatoes, are the Irish. It cannot be doubted that nearly or quite all the ills that trouble unhappy Ireland are due to the humble potato. The Irish are the meanest-fed people living in a civilized land of which we have any knowledge; they are in a condition of semi-starvation, even when in their highest prosperity.

Every visitor in Ireland is struck with the "pot-bellied" appearance of the natives, men and women. This abnormal distention of the abdominal walls is due to the enormous amount of potatoes which they are compelled to consume in order to maintain a tolerable degree of health. If this people would quit the cultivation of the potato, and supply its place with cereal grains, Ireland would soon become a happy and prosperous nation.

The Irish problem is regarded by English statesmen as an exceedingly intricate one. It is certainly of a nature which cannot be solved by angry debates in Parliament or by ministerial changes. But if the English landowners will take the trouble to visit Ireland, and remain long enough to change its soil productions from potatoes to cereal grains, Irish riots and discontent will soon cease.

Half-starved men and women can never be happy, and an exclusive diet of potatoes, no matter how large the quantity used, will only serve to maintain people in a feeble, half-starved, revolutionary, quarrelsome condition.

William Cobbet once wrote that the ruin of Ireland would result from the cultivation of that "dirty root," the potato. Adam Smith declared, years ago, that England would some day have to support Ireland if potato-culture was not abandoned for the raising of other soil products. He believed that the same extent of land which would grow food for one person in England would support four in Ireland. The soil is better, the climate is better; and the only need is, to throw seed-potatoes into the sea, and plant wheat, oats, barley, and other grains, instead of the innutritious tubers.

Chemical laws, whether those involved in the formation of a world or those connected with the sustentation and healthy condition of animal life, cannot be violated or ignored without causing evils of the greatest magnitude. It is well to remember this important suggestion if we desire to be happy and prosperous.

SIMPLE SCIENTIFIC EXPERIMENTS.

THE experiment of the Magdeburg hemispheres, illustrating the pressure of the air, can be cheaply and easily performed by taking two glass tumblers, placing a bit of lighted candle in one, and covering it with the other, first placing a piece of moistened blotting paper between them. The candle heats the air, which expands and escapes, and finally is extinguished for lack of oxygen. As soon as the air begins to cool, it contracts, and a partial vacuum is produced in the tumblers, the

FIG. 1.

wet paper forming a practically air-tight joint, and the whole apparatus can be lifted by the upper tumbler, the pressure of the outside air being sufficient to hold the lower one in place. The paper separating the tumblers is often broken by the expansion of the air in the upper tumbler, which is not rarefied by the candle; but this does not interfere with the success of the experiment, and is only another illustration of the atmospheric pressure.

TAKE two forks and join them together at an angle by the prongs, then slip between them a silver dollar. The weight of the han-

FIG. 2.

dles of the forks will bring the centre of gravity of the whole system much below the edge of the coin, which can be then placed in any position, and will always remain perfectly balanced. The engraving shows how the apparatus is constructed, and also how the coin can be balanced on the edge of a goblet while the water is poured out of it. It will also stand equally well on a knife-blade, or even the point of a pin.

THE simple piece of apparatus illustrated in

Fig. 3 will show the expansion of metals by heat as well as the more expensive pyrometers. It is made by cutting a piece of cork into the shape represented, and placing a needle, *AB*, across the opening; the pointed end being firmly fixed in the cork, while the eye end is free to move. A second needle, *D*, somewhat smaller, is passed through the eye

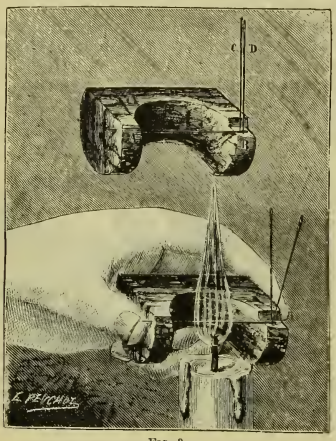


FIG. 3.

of the first, just far enough into the cork to enable it to stand upright. A third needle, *C*, is placed beside it, to make the movement more evident.

When the needle *AB* is heated in the flame of a candle, its expansion will push *D* from its upright position, to which it will return upon the subsequent cooling and contraction. Care

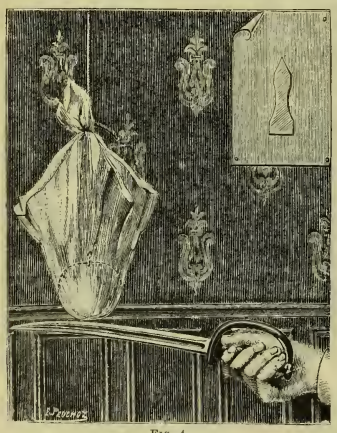


FIG. 4.

should be taken not to place the upright needle too far into the cork, as this might prevent its movement by the expanding metal.

A CURIOUS illustration of the principle of inertia can be shown by enveloping an apple in a piece of cotton cloth, and suspending it in the air. Then take a sword or sharp knife, and strike the apple a sharp, quick blow from below, being careful to give a direct and not a *drawing* cut, and the apple will be cut in two without injury to the cloth. The figure in the upper corner shows the section of the blade best adapted to this purpose; but any moderately sharp and brightly polished blade will answer, although several trials will probably have to be made before the experiment succeeds.

The engravings illustrating the above experiments are reproduced from *La Nature*.

RECENT ARCHÆOLOGICAL DISCOVERIES.

THE oldest flint implements that have been found were roughly chipped from the stone, and no attempt was made to smooth or finish them in any way; but, in the vast period of time which separates the palæolithic from the neolithic age, the inhabitants of Western Europe had either learned to finely polish their stone implements and weapons, or else, as is more probable, a new race of men had emigrated into the country, already possessed of the knowledge, and considerably advanced in civilization as compared with the degraded savage of the glacial period. A most interesting discovery has recently been made at Nemours in France, by M. Doigneau, of several polishing stones (*polissoirs*) on which the prehistoric inhabitants of the valley of the Loing gave the final finish to the stone implements, of which so many beautiful examples have been found.

The engraving (see p. 157) is taken from a photograph of one of the largest of these stones, and shows the depressions on its surface in which the flint was rubbed, probably with sand and water, until it was smoothed and polished. The depressions are of two kinds, — deep grooves, suitable for forming the edge of hatchets, etc., and shallow cup-shaped cavities for polishing their broader surfaces.

These stones are composed of a fine-grained quartzose sandstone, and about a dozen have been discovered. The locality was evidently a great prehistoric workshop or manufactory of flint implements, but it is remarkable that there are hardly any traces of broken or chipped pieces of flint in their vicinity. The articles were probably first formed in some other locality, and only brought to the polishing stones to receive the final finish. It may also indicate that in former times the river valley was subject to periodical overflows, and that the polishing industry could only be carried on at seasons of low water. The fact that the stones are barely three feet above the present level of the river, renders this supposition probable, and would also show that no very great changes in the physical character of the country have taken place since the polishers were in use, and would forbid the assigning of a very ancient date to that period. These interesting relics of prehistoric times have been purchased by the French government, and thus their preservation is assured.

Recent explorations in Spain by two Belgian scientists, the Messrs. Siret, have resulted in some very interesting discoveries. Relics of a prehistoric race have been found in great abundance, ranging from the stone age to that of bronze and metals. These people buried their dead not only in stone graves or cells, but also in great jars of burnt clay, accompanied by pieces of pottery and other articles of use and value. This form of jar-burial is very widespread, and examples have been found from Japan to Peru. These relics are supposed to belong to that ancient race which lived in Europe previous to the Aryan immigration, the various branches of which are known as Iberians, Pelasgians, Ligurians, etc., according to the country in which they lived.

Several skeletons were found adorned with silver and gold ornaments. One of the most remarkable is illustrated in Fig. 2. It is a female skull encircled by a band of silver, to which is attached a thin plate of the same metal. It is not known whether it was origi-

FIG. 2.

nally worn in the position as when found, or, as is most likely, had been accidentally displaced after burial. This skull was found in a cave near the station of Fuente-Alamo, where gold and silver are found in small quantities in the soil; and it is quite possible that in those ancient times the mining of the precious metals was a regular occupation of the inhabitants.

The accompanying illustrations are reproduced from *La Nature*.

[Specially reported for the *Popular Science News*.]

THE BRITISH ASSOCIATION AT MANCHESTER.

THE British Association for the Advancement of Science met this year at Manchester; and, notwithstanding wet and unfavorable weather, no place visited by the Association has ever had so large an attendance of members and friends. During the first day nearly four thousand persons registered, many of whom had come from a great distance. Eminent foreigners were present in all the sections, and, by taking an active part in the work of the Association, gave a distinctly international character to the whole proceedings.

This meeting was marked by an unusual number of pre-arranged discussions on wide and important subjects. Together the sections of physics and chemistry considered the subject of electrolysis, introduced by an able report from Professor Lodge, and a whole series of papers, including one by Professor Helmholz of Berlin. A joint meet-

ing was also held by the economists and geologists to discuss a paper by Mr. Topley of the Geological Survey on the future production of the precious metals, and one on "Bi-metallism" by Mr. Edward Atkinson of Boston.

Introduced by Professor Ray Lankester, the question of the hereditary nature of acquired characters elicited a lively and interesting debate among the English and foreign biologists; the general result being, that the point is still to be regarded one of considerable uncertainty, meriting thorough investigation. Special scientific interest was also attached to a discussion on the present aspect of the cell question, from which it appears that biologists are more and more limiting the term "protoplasm," and that names should be sought for those parts into which protoplasm is being anatomically divided. The geologists and the biologists discussed together the practical question of the arrangement of museum specimens. Dr. Henry Woodward of the British Museum proposed the plan of introducing, in some conspicuous place among the fossil remains of each class, recent types representing characteristic living forms, for comparison with the extinct ones. Professor Boyd Dawkins, on the other hand, was for dividing the ancient history of the earth into a series of chapters, recalling the ancient physical geography, and the groups of ancient forms of life, both animal and vegetable, in a regular graduated order of time.

Besides these prearranged discussions, there were in most sections others suggested by the papers read. In the department of mathematics and physics much time was devoted to spectroscopy; Professor H. A. Rowlan's description of a map of the solar spectrum exciting great interest, as did Sir William Thomson's paper on the "Vortex Theory of the Luminiferous Ether." In the geographical section there was a warm and prolonged discussion on the subject of geographical education, resolving itself into a question of what geography really is, if, indeed, there is any such thing apart from geology.

Technical education, land-tenure, agriculture, and subjects relating to money and changes in prices, were taken up in turn by the economists. A paper on the "Economic Policy of the United States," by Professor Leone Levy, drew a spirited reply from Mr. Atkinson; and later in the same day the "Battle between Free Trade and Protection in Australia" contributed some new material to the general question. The colonies of Victoria and New South Wales, although by no means identical in circumstances, have, one thing with another, a fairly compensatory adjustment. Victoria started, relatively speaking, decidedly behind New South Wales; but her enormous gold production quickly sent her far ahead. Her gold gradually falling off, she turned herself to increased agriculture, and also, by means of protection, to manufactures. Meanwhile New South Wales, under a free-trade policy, has been gaining steadily on her sister, and is already equal in population and substantially ahead in trade and revenue.

Volcanic papers were prominent in the geological section, one of the most important being that by Professor Judd on the natural history of lavas as illustrated by the materials ejected from Krakatoa. In this section Professor Seeley exhibited a fossil showing the development of the young of *plesiosaurus*. No more remarkable fossil has ever been found, and no incident in the history of fossilization is more singular than that which this specimen displays. The fossil is a series of mummies of minute plesiosaurs, less than five inches in length, which have the substance of their flesh perfectly fossilized, and their bones preserved within the flesh. The remains show different conditions of development. This is the only case that has ever occurred of the mineralization of the muscular substance, and the preservation of the external form, of these animals.

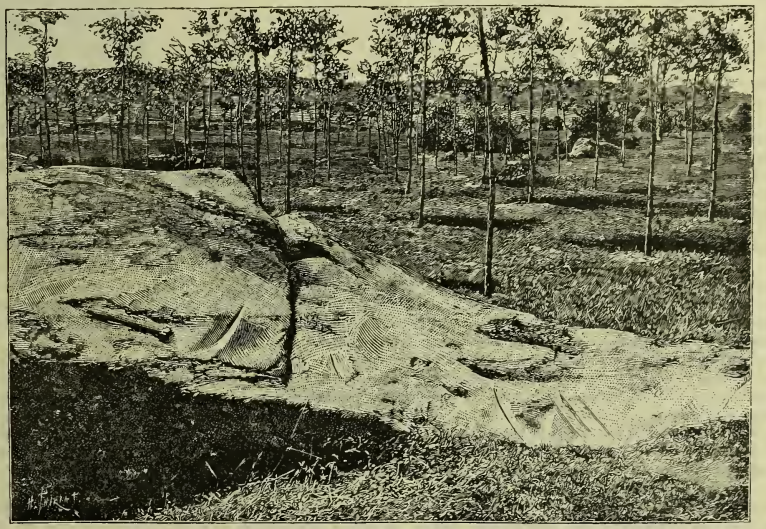


Fig. 1.—See Page 156.

The anthropological section was chiefly remarkable for the address of its president, Professor Sayce, who brought forward new facts and views regarding the primitive home of the Aryan race. Twenty-five years ago, the grammar and phonology of the Sanscrit language being imagined more faithful to the primitive pattern than those of its European sisters, it was argued that there had been little migration on the part of its speakers, and the home of the parent speech was sought to the north-west of India. Modern research, however, shows that Greek, or even the Lithuanian of unlettered peasants, has preserved, more faithfully than the Sanscrit of India, the features of the parent Aryan language; in the neighborhood of Lithuania, therefore, we ought to seek traces of the first home of the Aryans. Similar evidence has been obtained, by a careful comparison of the vocabulary of the Aryan family of languages, by Professor Otto Schrader, who four years ago approached the question from the present level of comparative philology. The speakers of the parent Aryan tongue, he finds, must have lived in a cold climate; and, as they were acquainted with the birch, their home must have been westward of a line drawn from Königsberg to the Crimea, to the east of which the tree does not grow. They must have lived in the stone age, with the skins of wild beasts only to protect them from the rigors of the winter, and nothing better than stone weapons with which to ward off the attacks of savage animals. The primitive Aryan was acquainted with fire; he could even sew his skins together by means of needles of bone, and, possibly, could spin a little with the help of rude spindle-whorls Of the working of metals he was entirely ignorant; but he already practised a kind of rude agriculture, while the community to which he belonged was essentially that of pastoral nomads, who changed, from season to season, their miserable beehive huts of wattled mud. The question of the particular race to which the speakers of the Aryan parent speech belonged, has lately been handled with great ability by an Austrian anthropologist, Dr. Karl Penka, in whose opinion they were the fair-haired, blue-eyed, light-complexioned dolichocephalic race, which is still found in its greatest purity in Scandinavia; and that it was this race which, in the neolithic period, spread southward, imposing its yoke upon subject populations, and carrying with it the dialects which afterwards developed into the Aryan languages. Following this address from Professor Sayce, came a paper by Canon Isaac Taylor, in which he also maintained that the origin of the race is to be sought in Northern Europe, and not in Central Asia. To Canon Taylor the Baltic provinces of Russia seem to be the centre of dispersion; and he therefore looks on the Aryans as an improved race of Finns, and recommends that comparative Aryan philology henceforth take account of the Finnic languages, as affording the oldest materials which are available for comparison.

In connection with the anthropological section an anthropometric laboratory was formed, for the purpose of making observations on the anatomical and physiological development of those attending the meeting. This laboratory was visited by over four hundred people; and the results will probably prove of an interesting character, showing, for instance, the almost entire absence of color-blindness among the educated classes.

Sir Henry Roscoe was this year the president of the Association, and his inaugural address is generally regarded as appropriate and equal to the occasion. He reviewed the steps by which our advance in chemical science has been made; and, after pointing to much that remains yet unknown, he referred to what has been accomplished during the Victorian era in the way of the diffusion of scientific knowledge among the people of England, and ended by saying, that, if the country is to maintain her commercial and industrial supremacy, science must no longer be ignored in the education of her people.

K.

[Original in *Popular Science News.*]

VOLAPÜK, THE WORLD-LANGUAGE.

BY P. F. BICKNELL.

THE necessity of a universal language as a medium of international communication has long been felt. As early as 1666 Leibnitz wrote his *Historia et Commendatio Linguæ Characteristicæ Universalis*, a work which caused its author much study. Yet this great mind wrestled with the problem in vain, and his efforts failed to bear fruit. In 1688 Bishop Wilkins put forth an *Essay toward a Real Character and Philosophical Language*, which, however, with Abbot Sicard's *Pasigraphie*, published ten years later, was soon forgotten. A greater degree of attention was attracted by Anton Bachmeier's system, which appeared in 1852, and employed the numerals as an alphabet. These and other schemes for a world-language all presented such difficulties and imperfections that they found only a few advocates, and lived but a short life.

In 1881 appeared still another system, and one which in this short time has gained such favor that it seems as if the problem had at last been solved. Johann Martin Schleyer, its inventor, is a native of Baden, being born at Oberlanda July 18, 1831. After attending the gymnasium in Tauberbischofsheim, and then in Karlsruhe, he continued his studies at the University of Freyburg, where he was graduated by the theological faculty in 1856. After a number of pastorates he retired from preaching in 1885, in consequence of failing health, and now lives in Litzelstettin on the island of Mainau in Lake Constance, receiving a pension of a thousand marks. On this pittance he supports himself, his aged father, and a sister; receiving, it is true, frequent testimonials in recognition of the value of his work, but not yet having met with that pecuniary assistance needful to the extension of his system. In the years of study that he devoted to the preparation of "Volapuk" Schleyer made himself familiar with more than sixty languages, among these nearly all the European tongues, and the most important Asiatic. We may say at the outset that he has favored the English language to a marked degree in choosing the elements for his system.

The name of the system itself, Volapuk, is referred to the English *world* and *speak*, the compound denoting "world-speech." Of the thirteen hundred roots in the language, about one-quarter are taken from the Latin and the romance languages, one-third from the English, one-fifth from the German, and the rest from the remaining field of the author's language studies, but more largely from the North-European tongues. The Volapuk dictionary now contains fourteen thousand words, while any imaginable new word may be easily formed by composition. All difficulties of pronunciation and spelling are avoided. No sound is employed which is not common the world over, every word is accented on the last syllable, and the orthography is strictly phonetic. No sibilant is admitted at the end of a declinable word, and the letters *r* and *c*, as well as the combination *ng*, have no place in the language; *h* has the sound of *ch*, and *j* is pronounced as in French. The rules of Volapuk grammar are few, and absolutely without exceptions. It is maintained that the language can be mastered in as many hours as it requires years to learn any one of the foreign languages.

Volapuk is a highly inflected language, but has only one declension and one conjugation. The declension embraces both substantives and adjectives, and has five cases, — nominative, genitive, dative, accusative, and vocative. The noun *lif* ("life") is thus declined: gen. *lifa*, dat. *life*, acc. *lifi*, voc. *lif*. The plural is expressed simply by adding *s* to the several cases of the singular. Adjectives are formed by adding the endings *ik*, *sik*, and *nik* to the substantive. *Lifik* is the adjective corresponding to the substantive *lif*. When a noun is qualified, both words may be declined, for the sake of greater emphasis, or only the noun. The comparative and superlative degrees are denoted by the endings *um* and *ün* respectively. Even substantives may be compared, as *lifum*, a better life; *lifün*, the best life. The language contains no article, whether definite, indefinite, or partitive. Strengthening and weakening particles are *le* and *lu:* e.g., *juit*, enjoyment; *lejuit*, great enjoyment: *keb*, a plant; *lukeb*, a weed. The negative prefix corresponding to the English *un* or *dis* is *ne:* e.g., *siäm*, sense; *nesiäm*, nonsense. The diminutive ending, corresponding to the German *chen*, the Latin *ulus*, is *lil*. Suffixes to denote abstract quality are *im*, *ef*, *od*, *öf*, and *ug*.

The verbal stems are all monosyllabic, as in Hebrew. The infinitive ends in *ön:* e g , *lif*, life; *lifön*, to live. The tenses of the finite moods are inflected by the addition to the stem of the pronouns, *ob*, I; *ol*, thou; *om*, he: plural, *obs*, *ols*, *oms*. In this manner we inflect the present indicative active of *lifon: lifob*, *lifol*, *lifom*; *lifobs*, *lifols*, *lifoms*. Prefixes and suffixes are employed to indicate change of tense and mood: *aelifob*, I lived; *olifob*, I shall live; *ulifob*, I shall have lived. The prefixing of *p* to the forms of the active turns them into the passive. The participle exists in theory, at least, in all tenses, being denoted by the suffix *oel;* the subjunctive characteristic is *la*, the imperative *oed*. A second imperative, or *jussive*, has the suffix *oez*. Like the Greek, Volapuk has the two optatives: the optative of wish, and the potential optative. Again, as in Greek, and somewhat after the analogy of the French reflexive verbs, we have a middle voice, indicated by the suffix *ok*. Question, negation, condition, and duration also have their ready means of expression by the use of suffixes.

This system of Schleyer's for a world-language has already more than 200,000 advocates, in 450 cities of Europe and 26 of America. Volapukists are also found in Africa, Asia, and Australia. A great business-house in Erfurt recently received a telegram from India written in Volapuk. Business-men are among the first to recognize its value. In Paris the house of M. Jaluzot, the *Grands Magasins du Printemps*, has already on its doors the sign "Volapukon," to denote that the world-language is spoken by its clerks. Professor Kerckhoffs recently opened a course in Volapuk in Paris, with 2,250 hearers. The new language is studied in the schools and universities of France, and 290 French papers publish occasional articles in the interest of the enterprise. Russia has recognized the importance of the movement, and lately authorized the use of the language in telegraphic despatches. In Italy are eight societies for the promotion of Volapuk : namely, in Turin, Milan, Genoa, Florence, Rome, Naples, Ferrara, and Vercelli. The Spanish central society is established at Guadalajara. Numerous societies have sprung into being in Germany and Austria. Munich publishes a comic journal in the new language, the *Cogabled*. Vienna supported two university courses during the past winter, while five others were maintained in different quarters of the city. The officers of the Austrian army were offered a course as well. Free courses were also instituted in Berlin, Munich, London, Madrid, and Moscow. There are now nine journals published in Volapuk, or devoted exclusively to its cause. Among the more eminent advocates of the new movement may be mentioned Professor Max Müller of Oxford, Professor Alfred Kirchhoff of Halle, and Francisque Sarcey, the *Temps* critic. In 1885 the first world congress of Volapukists brought together three hundred members. Another congress is planned for 1889 in Paris, on the occasion of the exposition.

That the author of the system designed to supplant any of the spoken languages is by no means the case. The office of Volapuk was to do the work which none of the existing languages was found able to do. A few hours of study and a dictionary of the new tongue enable any one to enter into communication with the most distant inhabitant of the globe. And, though so readily mastered, the language is yet capable of rendering the finest shades of meaning. Its admirable flexibility is illustrated by the verb; 504,440 forms are possible, and all mastered in ten minutes. Translations have already been made from the classics of German and English literature. Original essays and poems have been written, yet Volapuk must be acknowledged to be the language of prose rather than of poetry. The purpose of the inventor, to furnish a ready means of international communication, has been accomplished, and the work is worthy of its author's motto, "*Menade bal, pük bal*" ("One humanity, one language").

SCHUTZEN, STR., 10, II.
BERLIN, GERMANY, *Sept.* 12, 1887.

SCIENTIFIC BREVITIES.

ATOMIC WEIGHT OF SILICON. — T. E. Thorpe and J. W. Young have attempted to redetermine the atomic weight of silicon by estimating the quantity of silica yielded by decomposing known weights of silicon tetrabromide by means of water. The result of their experiments was to give the atomic weight of silicon as 28.332.

SIZE OF THE SILVER MOLECULE. — In an exhaustive paper upon methods of measuring thin films, Otto Wiener makes certain measures of the thickness of a film of silver which can just be perceived by the eye, and arrives at the conclusion that 0.2 millionths of a millimeter is an upper limit of the diameter of a silver molecule.

SOME ALLEGED NEW ELEMENTS. — A. Pringle claims to have discovered six new substances in some lower silurian rocks in Selkirk. Five are said to be metals, and the other is a substance resembling selenium, and which he calls *hesperisium*. One metal is like iron, but does not give the rhodanate reaction, nor that with tannin; another resembles lead, is quite fusible and volatile, and forms yellow and green salts; another is black, and he names it *erebodium;* the fourth is a light-gray powder; and the last is dark in color. For three of these elements the author assigns the equivalents 95.4, 43.6, and 74.

SOLIDIFIED CARBONIC DIOXIDE. — A specimen of solidified carbonic-acid gas was shown at the recent meeting of the Association for the Advancement of Science, and considerable interest was taken in it, from the fact that it was one of the largest cakes of this peculiar substance made. It was about the size of an ordinary brick, with the exception of being twice as thick. It looked like a mass of snow, and had a temperature of seventy-nine degrees below zero. Ether turned it into a liquid of about a hundred degrees below zero; and this will instantly freeze mercury solid, or turn alcohol to a sirup-like consistency.

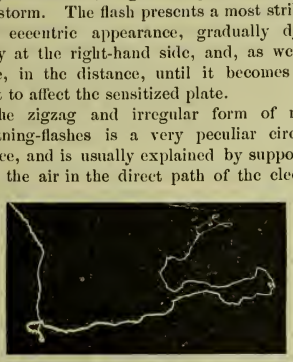
A FLAT LENS. — A lens which magnifies, and yet is perfectly flat on both sides, has been made at Jena by the manufacturer of Professor Abbe's new optical glass. The lens consists of a single disk, whose density varies so that its refractive power decreases regularly from the surface inward.

Practical Chemistry and the Arts.

PHOTOGRAPH OF A LIGHTNING-FLASH.

The illustration given below is from the *Electrical Review*, and is an exact copy of a flash of lightning photographed by Mr. Joseph Gray at Brixton, Eng., during a recent thunder-storm. The flash presents a most striking and eccentric appearance, gradually dying away at the right-hand side, and, as we believe, in the distance, until it becomes too faint to affect the sensitized plate.

The zigzag and irregular form of most lightning-flashes is a very peculiar circumstance, and is usually explained by supposing that the air in the direct path of the electric



current becomes compressed and condensed by its passage, thus increasing its resistance to the current, which is obliged to change its direction, and pass through air of less density, according to the well-known law, that an electric current always follows the path of least resistance. This is one of the most perfect and satisfactory photographs of a lightning-flash that we have ever seen.

CROWN GLASS.

The following interesting account of the manufacture of this old-fashioned variety of glass is taken from a lecture delivered by Professor C. H. Henderson before the Franklin Institute of Philadelphia. The "bull's-eyes" referred to are frequently seen in very old houses in the country, as well as in the more recent examples of domestic architecture.

"The manufacture of crown glass, though commercially much less important than that of sheet glass, possesses considerable historical interest, and within the past year or two has been brought into some prominence again from the use of the material in decorative windows. It possesses a brilliancy far superior to that of its younger rival; but the small size and unequal thickness of the panes obtainable do not permit it to successfully compete with the generous dimensions and constant uniformity of the sheet glass. The glass itself is alike in both; the differences between the two being due entirely to the subsequent manipulations, after the melting process has been completed. As before, the glass, by several successive gatherings, is collected on the end of the blowpipe, and, by rolling on a table of metal or stone known as the marver, is gotten into the shape of a cone, the apex of which forms the so-called "bullion point." The workman now blows into his pipe, expanding the glass into a small globe. This is subsequently enlarged, care being taken to keep the bullion point in the line of the blowpipe. The globe is then flattened to something of the shape of an enormous decanter, the bottom being very flat, and having the bullion point in its centre. The pipe and its burden are now permitted to rest horizontally upon two iron supports. In the mean time another workman has gathered a small lump of glass upon the end of his iron rod, or "pouty," and, by pressing it against an iron point, has impressed upon it the shape of a small cup. This is fitted over the bullion point of the glass, and soon becomes firmly attached to it. The blowpipe is separated from the glass by means of cold iron and a sharp blow. The open neck thus exposed is known in the glass-worker's parlance as the "nose," and gives its name to the furnace where it is subsequently re-heated. During this operation the pouty is constantly and rapidly revolved. Under the combined action of heat and centrifugal force the nose gradually expands, the opening growing larger and larger, until the piece has the shape of a typical crown. But this appearance remains only an instant; and in its place is seen a brilliant circular plate of glass, whose shape is only maintained by continuing the rotation of the pouty until the plate — or table, as it is now called — can be laid upon a flat support. The pouty is then detached from the bull's-eye by means of shears. As soon as they are sufficiently cool to be rigid, the tables are stacked in annealing ovens, where they remain from one to two days. Their diameters vary from a few inches to six feet, but the latter dimension is extreme. After annealing, they are divided by a diamond into two unequal parts, the larger of which contains the bull's-eye. It can readily be imagined that a semicircle of glass which has even the extreme radius of three feet cannot be cut into square panes very advantageously; and this consideration, together with the small sizes necessary in crown glass, have more than counterbalanced its admirable brilliancy.

"At the present time, crown glass in the circular form, just as it comes from the annealing oven, is being used in decorative windows with very excellent effect. The glass is frequently tinted, amber being a special favorite; or else it is white, with the bull's-eye colored. A very effective window of this sort may be seen in the hallway of the Tiffany Glass Works in New York. It consists simply of a succession of crown-glass tables, perhaps eight to ten inches in diameter, having opalescent and tinted bull's-eyes. The use of the bull's-eye alone is also becoming quite popular in mosaic window glass."

TEMPERING STEEL WITH ELECTRICITY.

At the shop of the Sedgwick Mainspring Company, Chicago, can be seen a very interesting application of electricity to the arts. It consists of tempering watch-springs by means of the electric current. In one part of the room stands what is known to the trade as a one-light dynamo The conductors from the dynamo lead to another part of the room to a bench, on which stands an ordinary oil-tempering bath. One of the conductors connects with a point within the oil-bath, and the other to a point without. The piece of flat, soft steel wire that is to be tempered to the blue color is fed under the contact-point on the outside of the bath first, and then under the one on the inside. When it reaches the latter the circuit is complete, and the wire immediately and uniformly becomes heated. No means have been taken to measure the current exactly, for the purpose of doing the whole work mechanically. The variation in the percentage of carbon in different pieces of steel forbids the delicate process of tempering from becoming a purely mechanical piece of work. Therefore, with the electric current as with a fire, the color of the steel determines the length of time that it shall be heated. Several advantages are claimed for this process of tempering. The chief one is, that the steel does not have time to oxidize, after it has been heated to the proper color, before it is under cover of the oil, and consequently that the steel wire is of the same thickness when it is tempered as it was before it entered the process. The heating is uniform throughout the length of the spring, and there is less liability of defective spots. The process is a rapid one, the springs being heated and passing into the bath at the rate of four inches a second.

The large watch-making concerns look with great favor on the new process, and the Sedgwick Mainspring Company are about to double their capacity for the purpose of keeping up with their orders. — *West. Electrician.*

A NEW METHOD OF CLEANING STONE-WORK.

It is sometimes required to clean the surface of old masonry that has become weathered or coated by deposits from dirty water, either for the sake of appearance or to make a sound connection with new work. The only effectual method hitherto practised has been by completely re-dressing the surface with the chisel, — a tedious and costly method. A different, and, it is claimed, a more satisfactory, process, has been devised by M. De Leilbhabert, which was recently used for cleaning the walls of the quays at Paris. These walls in a few years become covered with a shiny, black deposit, which resists acids. To remove it, a paste composed of a solution of soda and lime, to which a little chlorate of lime is added, was mixed to the consistency of honey, and spread over the surface, where it was allowed to remain for two or three hours, according to the condition of the stone. When it was removed, the deposit was still black; but it had become sensitive to acids. After this preliminary treatment, a workman passed over the surface (with a large gutta-percha brush) a mixture called sulpho-chlorhydric, forming on the stone a kind of glue, and almost immediately afterward he syringed the surface with a jet of the same liquid. It formed an adherent paste, continuing to act upon the stone for about two or three hours. After the syringing came a gang of men who scrubbed the surface, finishing off with a hose-pipe. The sulpho-chlorhydric mixture is composed of sulphuric and hydrochloric acids mixed empirically, according to the nature of the stone and the necessities of the case. The cost of cleaning stone walls by this method in Paris is 9.2 cents per square meter for material, and 10 cents for labor, by contract. The preliminary treatment by the caustic paste was paid for separately at 10 cents per square meter. It is said that the stone itself is not damaged by this treatment, and soon regains its natural color. — *Builder and Woodworker.*

PRACTICAL RECIPES.

To keep highly polished brass absolutely bright and free from tarnishing, thinly coat with a varnish of bleached shellac and alcohol.

Oil-Stains may be removed from paper by applying pipe-clay powdered and mixed with water to the thickness of cream; leave on for four hours.

To make Papier-Maché for fine, small work, boil clippings of brown and white paper in water, strain, and beat them into a paste; add glue or gum and size, and press into oiled moulds.

Coal Tar, thinned with naphtha to a proper consistency, is said to form a very good marking-ink, which will not wash out. Another kind is prepared by mixing two parts of powdered acetate of copper, four parts of sal-ammoniac, one part of lampblack, and twenty parts of water. Mix well together, and shake before using.

BRASS may be colored black by repeatedly coating the cleansed metal with a moderately warm solution of nitrate of copper. Heating over a charcoal fire follows. Finally the tone is heightened by rubbing with olive-oil.

CEMENT FOR LEATHER. — The cement used for patching the uppers of fine shoes is generally made by dissolving gutta-percha in methylated chloroform until the mixture is about as thick as sirup. Scrape and pare clean round the hole to be covered, and thin carefully with a long chamfer the edges of the bit of leather to be applied. Only a little of the cement is needed, but the surfaces must be pressed close together. The parts will adhere firmly in a few minutes.

TO MAKE PAPER ADHERE TO METALS. — M. Eliel gives the following formula for a mixture which can be used for metal, glass, or wood: Gum-tragacanth, 30 grams; acacia gum, 120 grams; water, 500 cubic centimeters. Dissolve, filter, and add 2½ grams of thymol suspended in 120 cubic centimeters of glycerine; then add enough water to make up the bulk to 1 liter. This bath will keep a long time.

CEMENT FOR FASTENING METALLIC LETTERS, ETC., ON GLASS. — Mix copal varnish, fifteen parts; linseed-oil varnish, five parts; oil of turpentine, five parts; glue, five parts. Dissolve the glue in the water-bath. When the mixture has been made, add to it ten parts of freshly slaked lime.

TO SILVER SILK RIBBONS. — Make a solution of nitrate of silver, and add a little gum to it, so that the liquid will not run. Then, with a camel's-hair pencil or a quill pen, draw any sort of ornamental figure on the silk. After the drawing is dry, hold the ribbon over a vessel containing water, zinc, and a little sulphuric acid. In a short time the silver will be reduced, and adhere quite strongly to the fabric.

A GOOD INK. — To make jet-black ink that is shiny and glistening when applied, dissolve in one-half pint of soft water three-eighths of an ounce of potassium bichromate, and add the solution to sixty ounces of logwood extract dissolved in one gallon of water; then dissolve in one gallon of water, by continued boiling, borax, six ounces; shellac, one and one-half ounces. Mix all together while warm, and add ammonia three ounces.

CLEAR SHELLAC VARNISH. — To get au absolutely clear solution of shellac has long been a desideratum, not only with microscopists, but with all others who have occasional need of the medium of cements, etc. It may be prepared by making an alcoholic solution of shellac in the usual way; a little benzole is then added, and the mixture well shaken. In the course of from twenty-four to forty-eight hours the fluid will have separated into two distinct layers, — an upper alcoholic stratum, perfectly clear, and of a dark-red color, while under it is a turbid mixture containing the impurities. The clear solution may be decanted or drawn off with a pipette.

LABORATORY NOTES.

PENCILS for writing upon glass, porcelain, and metals, in red, white, or blue, have been introduced by Faber in Germany. The composition consists of melting together spermaceti four, tallow three, and wax two parts; to the mixture is added six parts of either red lead, white lead, or Prussian blue, according to the color desired. The mass is turned out in sticks, and is then ready for use. These pencils bid fair to be a great convenience in the laboratory, as the marks are easily rubbed out, and save labelling.

PREPARATION OF CHLORINE WITHOUT HEAT. — Dr. C. Winkler has proposed a method for preparing chlorine in the cold, which is capable of use with Kipp's sulphuretted hydrogen apparatus. Chlorinated lime is mixed with its own weight of burnt gypsum, and dampened with water. The damp mass is then subjected to pressure between oiled cloths. The cake is cut into small cubes, and dried quickly at 20° C. The cubes should be kept in well-closed bottles. When used with Kipp's apparatus, pure hydrochloric acid diluted with its own volume of water is placed in the globe.

TO CLEAN BURETTES. — The following method is recommended as being superior to that of potassium permanganate. To a saturated solution of potassium bichromate an equal volume of sulphuric acid is added; when cool, the burette is filled with the liquid in the usual way. According to the character of the substance to be removed, it requires from six to twenty-four hours, when the instrument is carefully washed with water. Care must be observed to prevent contact of the hands with the liquid.

COMPOSITION FOR LABORATORY FLOORS. — The *American Druggist* is responsible for the following: 1. Mix together boiled linseed-oil and finely powdered coal to produce a substance of the consistency of paint. Apply a coat of this to the floor. 2. In a metal pot make a mixture of forty parts of chalk, fifty parts of resin, four parts of linseed-oil, and one part of native cuprous oxide; then stir in carefully one part of sulphuric acid. A sort of mastic results, which may be applied hot, and, when dry, forms a varnish of stony hardness.

A CEMENT for resisting sulphuric acid, even at boiling heat, may be made by melting caoutchouc at a gentle heat, and adding, with constant stirring, from six to eight per cent of tallow; then mix therewith enough dry-slaked lime to make the whole the consistency of soft paste; finally add thereto about twenty per cent of red lead, whereby the mass immediately sets hard and dry. A solution of caoutchouc in twice its weight of linseed-oil, aided by heating, and the addition of an equal weight of pipe-clay, yields a plastic mass which will resist most acids.

INDUSTRIAL MEMORANDA.

TOBACCO-WASTE. — A new use for the tobacco-plant has been discovered. Its stems and waste, it is claimed, are equal to linen rags in the manufacture of paper.

EMERY-CLOTH FILES. — An ingenious device for stretching emery cloth for use in workshops, consists of a couple of strips of wood about fourteen inches long, hinged longitudinally, and of round, half-round, triangular, or any other shape in cross-section. On the inside faces of the wood strips are pointed studs, taking into holes in the opposite side. The strip of emery cloth is laid on to one set of the studs, and the file, as it is called, closed, which fixes the strip on one side. It is then similarly fixed on the other side, and thus constitutes what is called an emery file, which is a handy and convenient arrangement for workshop use.

A NEW METAL INDUSTRY. — *Kuhlow's* says that in Germany gold, platina, and silver strips are welded, after the mosaic style, upon a metal ground prepared by the incandescent process, then compressed by means of powerful presses, and finally elongated by rolling into long sheets or strips. These sheets, which are now of all colors, — yellow, red, green, white, gray, and black, — are made into scarfs and neckties, which, being indestructible, are considered of some practical worth. This novelty, it appears, has found great acceptance abroad; numerous orders for export having been received by the manufacturers.

Home, Farm, and Garden.

[Original in *Popular Science News.*]

THE MYSTERIES OF PLANT-GROWTH.[1]

BY FRANCIS WYATT, PH.D.

IX.

To illustrate the effect of accompanying fertilizing salts upon the sulphate or chloride of potassium, we have only to imagine a mixed fertilizer containing, in suitable proportions, superphosphate of lime, sulphate of ammonia, and muriate of potash.

As soon as this compound reaches the soil, a reaction is commenced between the whole of the salts, resulting in the production of phosphates of ammonium and potassium, and sulphate and chloride of calcium.

The two latter will be washed down into the subsoil by the rains, and carried away, while the two first will enter the roots, and be very readily decomposed in the sap, and utilized by the plant.

If, instead of the above, we choose a mixture of nitrate of soda, and either the muriate or the sulphate of potash, we shall find that a similar transformation takes place; chloride or sulphate of sodium being produced on the one hand, and nitrate of potash on the other.

Dispensing with unnecessary reiteration, these typical examples sufficiently illustrate the importance and advisability of making preliminary trials upon a small scale, with each salt, in every case where the use of potash has been determined upon, since, under the varying influences of the different elements in every soil, the most uncertain and unlooked-for results may be obtained.

For those who engage in agricultural pursuits as a profession or trade, there is one, and only one, great question at issue when the employment of a fertilizer becomes imperative, and that question is, What substance contains the acquired element in a form which will yield the quickest, surest, and largest return for the capital expended on its purchase? Anticipating this question, I have endeavored to show that the carbonate and nitrate are naturally indicated, by their chemical constitution and qualities, as the most rational means by which to supply the potash needed by the immediately forthcoming crops; but, as I have also shown that there are several reasons why neither of them may be universally employed, it only remains to exercise sufficient intelligence and careful forethought, in order to produce combinations in which the use of the two other salts will be productive of equal profit and satisfaction.

As all farmers are familiar with the use of lime, and have been so for centuries, it would almost seem superfluous, at the first glance, to devote a chapter to so well-worn an institution.

If I have made up my mind to do so, it is because I am convinced, that, despite its antiquity and popularity, very few people know the exact reasons for its application, or clearly understand that its influence for good or evil depends entirely upon the physical and chemical constitution of the soil.

To throw the greatest possible light upon its action from all points of view, therefore, and thereby correct a considerable number of prevailing misconceptions, will be the object of my present endeavors.

Commencing with its base: calcium was first obtained in a metallic state by Sir Humphry Davy as a sequence to his brilliant discoveries of sodium and potassium. It is a bright but pale yellow metal, softer than zinc, but harder than tin, and easily malleable. It decomposes water very rapidly at the ordinary temperature, and, when heated in the open air, burns with a flame which — if only of

[1] See advertisement of Charles Scribner's Sons, p. 9.

short duration, owing to the prompt formation of oxide — is dazzling in its intensity. It combines with molten sulphur and the vapors of phosphorus to form sulphide and phosphide of calcium, and readily dissolves in diluted hydrochloric, sulphuric, and nitric acids. In its various combinations it is more generally employed in the arts and manufactures than any other metal, and in the form of carbonate constitutes the different species of limestone which are met with in such abundance in the earth's crust. The elementary composition of carbonate of lime is made up of

Calcium (Ca)	40 parts.
Carbon (C)	12 "
Oxygen (O)	48 "
	100 parts.

Or, to express it in another and perhaps a more simple way, —

Calcium (Ca)	40 parts.
Oxygen (O)	16 "
Carbonic-acid gas (CO_2)	44 "
	100 parts.

When carbonate of lime is burnt in a kiln with a proper draught, all the carbonic-acid gas, or forty-four per cent of its weight, is driven off into the air by the process of combustion, and the calcium and oxygen are left alone together, in the form of oxide, or *quick-lime*.

This quick or burnt lime, or calcic monoxide, is composed, for every hundred parts, of

Calcium (Ca)	71.43
Oxygen (O)	28.57
	100.00

It has a caustic, alkaline taste, and such an affinity for water, that, when sprinkled with that liquid, it combines with great violence, producing such intense heat in so doing, that, if any combustible material be present, it will burst into a flame.

By this treatment with water it becomes hydrated, or, as it is commonly called, *slaked lime*, and undergoes a change in composition represented as follows : —

Lime (CaO)	75.67
Water (H_2O)	24.33
	100.00

The important objects for which lime is employed are two in number, and cannot be too forcibly impressed upon the memory : —

First, To exercise a chemical action upon the numerous constituents of the soil, and thereby produce a complete modification of its physical and chemical properties.

Second, To furnish it with the quantity required by plants for their alimentation and growth.

And I may here very conveniently introduce a short table, showing the exact amount in which it is annually taken away per acre by the following crops: —

1 ton of tobacco (leaf and stem)	160	pounds.
20 tons of turnips (including tops)	100	"
1 ton cotton fibre (seed and stalks)	70	"
100 bushels of potatoes (including tops)	60	"
1 ton clover hay	45	"
100 bushels of corn (ears and stalks)	45	"
30 bushels of wheat and straw	15	"
30 bushels of rye and straw	15	"
50 bushels of oats and straw	12	"
30 bushels of barley and straw	12	"

From these figures it will at once occur to the reflective mind, that, while lime may be an essential constituent of their organisms, it is of less direct importance to plants as a food than either nitrogen, phosphoric acid, or potash; but, even if we place the average total actually removed by crops of all kinds during a year at fifty pounds per acre, a soil need only contain one-half of one per cent to supply all the demands made upon it during several hundred years. We must accordingly, if we would fully appreciate its agricultural value, turn to other directions, where, fortunately, both ancient experience and modern research into causes and effects have provided more than sufficient data to satisfy us that its principal attribute is not that of a fertilizer, but of an amendment.

[Original in *Popular Science News.*]

THE ORIGIN OF THE PEACH.

BY K. B. CLAYPOLE.

The belief that the peach is a native of Persia has been held so long, and has become so general, that to question it savors of heresy. Nevertheless, within the last few years M. Alphonse de Candolle, an eminent French botanist, has shown that this widespread belief rests at best on a doubtful inference. This inference first appears in the works of that indefatigable naturalist, the elder Pliny. "The peach," he says, "from its very name [Persia], seems to be exotic to Asia Minor and to Greece, and to have been introduced from Persia."

That the peach was brought into Europe from Persia may be admitted without hesitation; at the same time, it is difficult to attribute an ancient culture of the peach to Persia, when we consider the comparatively modern date at which that culture began in Italy and Greece. Pliny, in his *Natural History*, says that the peach was taken into Italy after the time of Cato, and there is no reason to doubt his statement. Pliny, as is well known, lost his life in the eruption of Vesuvius that destroyed Pompeii; and on the walls of the larger houses of that ill-fated city may still be seen, in soft, clear colors, the flowers, foliage, and fruit of the peach. The species, therefore, must have entered Italy somewhere between the death of Cato, 148 B.C., and the destruction of Pompeii, 79 A D.

It is natural to suppose that the Greeks were the first of the European nations to receive this Eastern fruit. M. de Candolle suggests that a vague rumor of it may have been among them from the time of the retreat of the Ten Thousand (401 B C.), though Xenophon, their leader, careful to tell of the fruits that he saw on his perilous march, makes no mention of this one, so attractive to sight and taste. The expedition of Alexander the Great to India, eighty years later, made known to the Greeks many new and delightful fruits; but in the description of them written (332 B.C.) by Theophrastus, the disciple of Aristotle, we seek in vain for any indication of the peach.[1] As it is impossible to believe that this luscious fruit could have been overlooked by Alexander, had it been growing in any of the countries through which he passed, we must infer that at the end of the third century before Christ the peach was unknown to Western Asia.

At the present day the peach is largely cultivated in the northern provinces of India, but it is called there by Arabic and Chinese names, and no name for it has been found in the ancient Sanscrit language. On the testimony of language, therefore, the introduction of the tree into India cannot be ascribed to any distant date. And yet the Hindus, as well as the Greeks and Romans and other nations of Europe, are the descendants of the ancient race whose home was to the north of the Euphrates, and close to, if not included in, the district usually assigned to the peach. On the supposition that the peach is a native of Persia, it seems unaccountable that neither the fruit itself nor a tradition of it was carried east or west in the migration of the people. More than this, it is doubtful, from the facts already cited, and the absence of any Hebrew name for the peach, if even antiquity can be claimed for its culture in Persia. Means of intercourse between that country and neighboring nations were not wanting; it is therefore incredible that she should have been able to keep to herself, for any length of time, a fruit so attractive to sight and taste, and so easy to propagate, as the peach. This is still more incredible when one considers that in China, a country separated from Persia by a long chain of mountains, and the cold, bleak plains of Central Asia, the peach was known and mentioned in writing many centuries before it made its way into Europe. Its name appears in the books of Confucius five hundred years before the Christian era, and it is also to be found in a sacred manual of five hundred years earlier still.

At the present day peach-trees grow with great freedom and luxuriance in China. In the same garden may be seen the velvet peach and the smooth-skinned nectarine in every variety of color and form, — the honey peach, elongated and crooked, like a bottle-gourd; and the *peen-to*, flattened out until the ends of the stone almost protrude from the skin. Nor is it on the fruit alone that the Celestial has exercised his skill. To please the eye, the blossoms have been doubled, the leaves changed in color and form, and the branches taught to droop; while, to gratify a taste for the abnormal, the whole tree, dwarfed to one foot and a half, bears its load of fruit in a small ornamental vase.

The Chinese artist likes to introduce into his paintings the figure of a peach very red on one side and with a little pointed tip; and, as such a peach is the symbol of a long life, he must never omit it from presents of congratulation. To the eating of peaches with some other fruits is ascribed the immortality enjoyed by many of the emperors. There is one variety of peach which will, if eaten just at the right time, protect an ordinary man from death. Should he, unfortunately, be a little too late, it will at least preserve his body from decay until the end of the world.

These superstitions, occurring as they do in the oldest manuscripts, show that the peach was well known in China at a very early date. Some legends, such as the *Chou-y-ki*, which says, "Whoever eats peaches from the mountains of Kouoliou obtains a life eternal," seem to M. de Candolle to go farther, and indicate that, at one time at least, the tree was believed to be indigenous. However this may be, the fact that it is called in China by a name of one syllable only (*to*) is in itself sufficient evidence that the fruit has been in the country so long that there is no remembrance of its introduction.

Of late years there has been a tendency among naturalists to regard the peach as a modified almond. Darwin himself inclined to this view, and in one of his later works he put forth the facts that seemed to him to support it. Of these the most striking are the hybrid produced by fertilizing a seedling almond with the pollen of a peach, and the French peach-almond, which bears strong resemblance to both trees, and whose fruit varies from year to year between the thin shell and tough, bitter flesh of the almond, and the hard stone and sweet, juicy pulp of the peach.

The attention of Darwin seems to have been turned to the almond as the ancestor of the peach, through the failure of botanists to find in any part of the world a specimen of the latter which can be accounted really wild It is true that all over China, and in Persia, the north of India, and many other parts of Asia where the fruit is largely culti-

[1] M. de Candolle says that Theophrastus mentioned the peach under the name of a "fruit from Persia." A reference, however, to the passage quoted by M. de Candolle shows that Theophrastus was speaking of an entirely different tree.

vated, young trees spring up, and thrive without the aid of man, just as in America they may be seen beside the Ohio country roads, on the hillsides of Middle Pennsylvania, or hanging over the rapids at Niagara. Travellers of a hundred years ago thought they had found the tree in a state of nature in the Caucasus, and the naturalist sent out by the Empress Catherine to explore the confines of her dominions reported the same variety from the north of Persia and the Crimea. He described it as a small bush-like tree, bearing fruit the size of a walnut, with little flesh, and that harsh and bitter. Fifteen years' residence in the most fertile part of the Crimea gave him ample time for investigation; and, in his opinion, even this depauperated peach could not be considered wild, but a remnant, rather, of some former cultivation struggling with adversity.

On the other hand, the almond, though, like the peach, endowed with a remarkable power of naturalization, is undoubtedly found wild in Syria and Anatolia. Many excellent botanists would give it a range from Mesopotamia and Turkestan to Algeria, and perhaps extend its habitat to Sicily and Greece. It has become naturalized in Persia, and bears there a native name; but farther eastward it grows with difficulty, and it is doubtful whether it has been at any time cultivated in China, even as an ornamental shrub. The almond is essentially a species of Western Asia. In both its varieties, bitter and sweet, it is repeatedly spoken of by the earliest Greek writers; while its mention among the presents sent by Jacob to appease his son Joseph in Egypt is sufficient evidence that it was known at a very early period to the Hebrews.

What is now to be said of the origin of the peach?

No one who has seen the almond-tree in flower or fruit can deny its near connection with the seedling peach; but that one is the offspring of the other, is, as M. de Candolle has clearly proved, impossible. The peach, a species of the far East, was cultivated in China for ages before it appeared in Western Asia and Europe; while the almond, a native of Syria, and cultivated by the neighboring nations from prehistoric times, has hardly yet been grown successfully farther to the east than Persia.

Botanical geography puts a whole continent between these trees, separating them so far that one can see no connecting link. Nevertheless, such a link there must sometime have been, and in all probability it belongs to the past, whose record still lies hidden in the strata of Northern Asia. Geology has already shown us the ancestors of many of our present plants; it may be, that some day there will be brought to light the parent of the peach and almond, that ancient tree whose descendants, coming to the South, varied with their varying circumstances until from the kernel Western Asia produced one of our most valued nuts, and Eastern Asia developed from the flesh a fruit esteemed above all others for its sweetness and flavor.

[Original in *Popular Science News.*]

AMBRETTE.

BY W. P. UNGERER.

MANY of our Southern States have wonderful natural advantages in their capacity as to plant-growing, and especially their adaptation to the production of the more valuable sorts.

Ambrette is little, or not at all, known to the medical or drug profession, although the amount of importations has been increasing gradually, and has tripled since the year 1882, and we are now forced to an annual importation of fifty thousand pounds.

The product of this important plant is in large demand by perfumers, tobacconists, liquor-dealers, and many others.

Ambrette is of Egyptian origin, known under the names of *Grana moschata* and *Hibiscus abelmoschus*. The seeds only are used: they are kidney-shaped, and of a grayish-brown color. They have an agreeable musky odor, being often falsely called musk-seed, on account of their odor resembling musk. Ambrette is an anti-spasmodic, although not used in medicine, but finds a large field for it's uses in perfumery.

Its precious grain was very scarce in 1885, and, from the normal price of sixty to eighty cents per pound, brought the enormous prices of two dollars and two dollars and a half per pound, and then was of inferior quality.

The following account of an experiment in its culture will, no doubt, be of interest to our farmers and cultivators of the South; and I even think that this profitable plant may be introduced with success into some of our Northern States.

As the demand increases here daily, I venture upon this subject with pleasure. I must first remark, that, in order to have success with this plant, it is necessary to get good, sound seed; and we can only be sure of this in buying from a reliable dealer. Secondly, the method and time to plant are not those which are generally to be found in manuals or other agricultural works, whose only view may be to raise from the plant its flowers; resulting in the gathering of the seeds either too early or too late in the season, thus losing their aroma, which is the most serious consideration for their value.

In making a trial in 1885 in New Jersey, I planted the seed two inches deep, three feet apart, in a very rich soil. The stalks were, in July, about three feet high; blooming in August, the seeds were ripe in November.

The flowers were large and showy, light purple in color. The ovary is five-celled, — first green, but soon turns red, and on ripening turns black, — opening out and showing the seed; its leaves large and oval, of a dark green on the top, downy gray beneath, and unctuous to the touch.

I obtained from a single plant two ounces of the seed, which was worth at that time twenty-five cents. My experiment, rather more scientific than practical, convinced me that the quality did not come up to the standard, in sweetness and strength of odor, of that of the same seed of the Orient. But it helps to convince me, that, if planted in a climate like that of Florida, or even warmer, the seeds will develop their desired aromatic principle.

In Cuba, where this plant flourishes admirably, an experiment of ambrette culture has recently been undertaken by unsuccessful sugar-planters, and the product sold in New York with good profit. The samples which I have seen were of good quality.

In concluding, I cannot refrain from saying that I am of the opinion that this culture may exceed and yield as large a margin to the cultivator as sugar or tobacco; and perhaps the result may be of more than usual interest.

The best quality of seed comes from Arabia and India.

HINTS FOR WINTER GARDENS.

CINERARIAS. — Few pot-plants present a more attractive appearance in late winter and early spring than do the cinerarias when at the height of their beauty, bearing, as they do, immense clusters of bright, handsome flowers boldly above the bright leaves. They are capital plants for a cool greenhouse, or, with care, in a window, and are raised from seeds sown annually at any time from July to September. The seeds are fine, and require careful treatment in sowing, to begin with. As soon as the young seedlings can be handled, they should be potted into small pots, and given a place near the glass. A low sash frame that is covered with shaded glass is a good place for them until Oct. 1. Always shift the plants into larger pots before the roots mat around the ball of earth, as their growth is liable to be checked most unfavorably if they become pot-bound. The plants like a rich soil abounding in sand and vegetable fibre.

LILIES should always be re-potted in autumn, and kept in a cool frame, or other cool, moist place, all winter. They begin to grow in the spring, and, as soon as the weather will permit, plunge the pots in ashes or sphagnum, where they can be kept from drying out during the summer. Success in growing lilies in pots may be achieved when a total failure would result from planting them in beds.

BEGONIAS. — "If obliged to confine myself to one class of plants for window culture, I would," writes a correspondent of the *Horticultural Times*, "select the flowering begonias. They bear dry heat and occasional neglect as well as any, and are not liable to the attacks of insects, while the number and variety of species are large. Next to begonias I would place geraniums. Every one knows how endless is the variety of shades and forms of these beautiful flowers. Then the scented, the silver-leaved, the bronze, the ivy-leaved, the tri-colored, — a charming array. One can have a gay window without any flowers at all. The list of desirable plants is almost endless."

LARGE PLANTS IN SMALL POTS. — It is well known that geraniums will bloom earlier and better in small pots than large ones, and the small pots are much the more convenient for them and other plants in windows, where large ones are unsightly, and take up much room. It is an interesting experiment to keep a plant in continual and perfect bloom all summer, in a pot which, compared with its own bulk, is so diminutive that it is a wonder to the uninitiated how such a grand dome of leaves and flowers could possibly have developed from such a thimbleful of soil. The secret is in using once or twice a week, after the roots have filled the soil, dilute liquid manure, which is immediately appropriated if the roots have not been left so long without food or drink as to be starved and shrunken. Soot is an excellent article for use in this way.

A "WATER-LIGHT." — A new principle for keeping plants through the winter without artificial heat was recently shown at the Regent's Park, London, with the plants grown in them last winter. The essence of the invention is, that all light and heat shall previously pass through a shallow layer of water. The water is found to exercise great control over temperature, protecting plants entirely from frost in winter and from excessive direct heat in summer. The application involves no difficulty. In the case of a garden frame, a sliding "water-light" about three inches deep is made to fit over the frame containing the plants; the only difference from a glass light being, that it holds water, and is always placed in a flat position. The depth of water generally kept in the tank is about two inches in winter and summer, and half the depth in spring and autumn.

TO DESTROY INSECTS. — One of the cheapest and best modes of destroying insects in pot plants is to invert the pot, and dip the plants for a few seconds in water warmed to 130°. A German paper, referring to this plan, says that the azalea will stand 133° without injury. We usually heat the water pretty well, and pour in cool until 130° is reached.

The Popular Science News.

BOSTON, NOV. 1, 1887.

JAMES R. NICHOLS, M.D.
WILLIAM J. ROLFE, A.M.
AUSTIN P. NICHOLS, S.B. } . . . . . *Editors.*

We have always been of the opinion that the destructive effects of a lightning-stroke are due more to the sudden expansion of air or moisture, by the intense heat developed by the passage of the current through a body of high electrical resistance, than by any direct mechanical effect of the discharge itself. In the case of a factory chimney which was struck some years ago at Lawrence, Mass., we found that the mortar contained a large amount of chemically combined water, which, if suddenly converted into steam, would be sufficient to produce all the destructive effects which were observed. Some occurrences which took place during a thunder-storm of exceptional severity which passed over North-eastern Massachusetts last September, tend to confirm this view. Numerous chimneys were struck by lightning, and in almost every case it was reported that the doors of stoves in the rooms below were either blown open or had the plates of mica in them torn apart. In these cases the expansion of the air in the chimneys and stove-pipes by the sudden heating was very clearly proved by these effects, which could hardly have been due to any other cause.

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On the evening of Sept. 15 the north-eastern part of the United States and adjoining parts of New Brunswick were illuminated by the passage through the air of an immense meteor, the light of which was visible from Boston to Halifax. The light was of a distinctly blue color, and the appearance of this strange celestial visitor was the cause of much excitement among those who witnessed its flight. A railroad engineer of an imaginative turn of mind reported that it fell alongside of a station on the New Brunswick Railway, and gave such a circumstantial account, that the story of "an aerolite as big as a box-car" was telegraphed all over the country. Several newspaper reporters — a representative of the *Science News* among them — immediately started for New Brunswick to investigate the wonder, but quietly returned the next day, after the hoax was discovered, with very pronounced views regarding railroad men, but with little additional knowledge regarding aerolites. This meteor, which probably fell into the sea, must have been of extraordinary size, as is shown by the great extent of country over which its light was visible; and it is to be greatly regretted that it did not reach the earth in some locality where it could have been secured for examination.

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We have recently been shown an "Indian pestle" found in Haverhill, Mass., which presents a very unusual and interesting variation from the usual form. It is of the familiar "rolling-pin" type, being roughly cylindrical, and slightly tapering towards the ends; but on the side, there is a surface several inches in length which has been rubbed flat, and evidently used as a sharpening surface either for metallic or stone implements. It is composed of a fine-grained stone very suitable for such a purpose, and was, in fact, used for some time as a whetstone by the person who found it. It is probable, that, after the stone had been fashioned into the pestle form, the Indian owner discovered its value for such a purpose, and so diverted it from its intended use. It bears no evidence of great antiquity, and was, very likely, used to sharpen knives or other tools procured from the early English settlers.

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The glass disk from which the photographic "corrector" for the great Lick telescope will be made, has arrived from France at the establishment of Alvan Clark's Sons in Cambridgeport. This glass will be supplementary to the one used for direct observation which was finished some months ago, and will be adjusted to the refrangibility of the actinic rays of light, and used in photographing celestial objects. It will be remembered that the first one burst in the process of grinding, owing to an internal strain from imperfect annealing. The value of this uncut piece of glass is about four thousand dollars, and it is to be hoped that no further accident will attend the completion of the work.

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DR. ROSCOE'S INAUGURAL ADDRESS.

The inaugural address of Sir Henry E. Roscoe, the president of the British Association for the Advancement of Science, was principally devoted to the progress of chemistry during the last fifty years, and necessarily contained little that was new. Some of the statements regarding the molecular theory, however, are so concisely stated, that we think they will be of interest to our readers. Thus, regarding the supposed absolute size of atoms and molecules, he says: —

But modern research has accomplished, as regards the size of the atom, at any rate to a certain extent, what Dalton regarded as impossible. Thus, in 1865 Loschmidt of Vienna, by a train of reasoning which I cannot now stop to explain, came to the conclusion that the diameter of an atom of oxygen or nitrogen was a ten-millionth of a centimeter. With the highest known magnifying power we can distinguish a forty-thousandth part of a centimeter; if, now, we imagine a cubic box each of whose sides has the above length, such a box when filled with air will contain from sixty millions to one hundred millions of atoms of oxygen and nitrogen. A few years later William Thomson extended the methods of atomic measurement, and came to the conclusion that the distance between the centres of contiguous molecules is less than a five-millionth and greater than a billionth of a centimeter; or, to put it in language more suited to the ordinary mind, Thomson asks us to imagine a drop of water magnified up to the size of the earth, and then tells us that the coarseness of the graining of such a mass would be something between a heap of small shot and a heap of cricket-balls. Or again, to take Clifford's illustration, you know that our best microscopes magnify from six thousand to eight thousand times; a microscope which would magnify that result as much again would show the molecular structure of water. Or again, to put it in another form, if we suppose that the minutest organism we can now see were provided with equally powerful microscopes, these beings would be able to see the atoms.

Regarding the latest theory of the motion of the molecules of gases, —

Whether we conceive the particles to be revolving round one another, according to the hypothesis of Davy, or flying about in every direction, according to Herapath's view, the pressure of the gas will be in proportion to the *vis viva* of its particles. "Thus, it may be shown that the particles of hydrogen, at the barometrical pressure of 30 inches at a temperature of 60°, must move with a velocity of 6,225.54 feet per second, in order to produce a pressure of 14.714 pounds on the square inch;" or, to put it in other words, a molecular cannonade or hailstorm of particles at the above rate — a rate, we must remember, far exceeding that of a cannon-ball — is maintained against the bounding surface.

We can, however, go a step farther, and calculate with Clerk Maxwell the number of times in which this hydrogen molecule, moving at the rate of seventy miles per minute, strikes against others of the vibrating swarm; and we learn that in one second of time it must knock against others no less than eighteen thousand million times.

These figures are almost incomprehensible, and it is even harder to believe that they rest upon any basis of fact; but it is none the less true, that, like the so-called atomic weights, they do represent the numerical values of certain properties of matter, and this regardless of the actual existence or non-existence of either atoms or molecules.

Prout's hypothesis is alluded to as follows: —

What is, then, the result of these most laborious experiments? It is, that, whilst the atomic weights of the elements are not exactly either multiples of the unit or of half the unit, many of the numbers expressing most accurately the weight of the atom, approximate so closely to a multiple of that of hydrogen that we are constrained to admit that these approximations cannot be a mere matter of chance, but that some reason must exist for them. What that reason is, and why a close approximation, and yet something short of absolute identity, exists, is as yet hidden behind the veil; but who is there that doubts that, when this Association celebrates its centenary, this veil will have been lifted, and this occult but fundamental question of atomic philosophy shall have been brought into the clear light of day?

The following fact will probably be new to many: —

We have seen that chemical change is always accompanied by molecular motion, and further evidence of the truth of this is gained from the extraordinary chemical inactivity of pure unmixed substances. Thus, pure anhydrous hydrochloric acid does not act upon lime, whereas the addition of even a trace of moisture sets up a most active chemical change; and hundreds of other examples of a similar kind might be stated.

Dr. Roscoe takes a very conservative view of the question as to whether the elements are formed from one primitive substance, and concludes that at present there is not enough evidence to warrant us in considering them as any thing but undecomposable forms of matter.

Passing on to organic chemistry, recent advances in the synthesis of organic substances are referred to: —

Another interesting application of synthetic chemistry to the needs of every-day life is the discovery of a series of valuable febrifuges, amongst which I may mention antipyrin as the most useful. An important aspect in connection with the study of these bodies is the physiological value which has been found to attach to the introduction of certain organic radicals, so that an indication is given of the possibility of preparing a compound which will possess certain desired physiological properties, or even to foretell the kind of action which such bodies may exert on the animal economy.

The limits of our synthetic powers, however, stop at the line between life and death, and the enormous difference between animate and inanimate matter is thus referred to: —

It is true that there are those who profess to foresee that the day will arrive when the chemist, by a succession of constructive efforts, may pass beyond albumen, and gather the elements of lifeless matter into a living structure. Whatever may be said regarding this from other stand-points, the chemist can only say that at present no such problem lies within his province. Protoplasm, with which the simplest manifestations of life are associated, is not a compound, but a structure built up of compounds. The chemist may successfully synthesise any of its component molecules, but he has no more reason to look forward to the synthetic production of the structure than to imagine that the synthesis of gallic acid leads to the artificial production of gall-nuts.

But when the life-line is once passed, the chemist can again take up his work, and the chemistry of the physiological processes becomes an important branch of the science.

In this connection, a very interesting fact is given regarding microbes: —

It is now believed by many that the symptoms of certain diseases are no more due to the microbes which constitute the infection than alcoholic intoxication is produced by the yeast-cell, but that these symptoms are due to the presence of definite compounds, the result of the life of these microscopic organisms. So it is to the action of these poisonous substances formed during the life of the organism, rather than to that of the organism itself, that the special characteristics of the disease are to be traced; for it has been shown that the disease can be communicated by such poisons in entire absence of living organisms.

We may even go farther, and speculate upon the possibility of a mental chemistry; for, as Dr. Roscoe remarks, —

Although incapable of exact expression, the mind exerts none the less an important influence on the physics and chemistry of the body, so that a connection undoubtedly exists between intellectual activity or mental work and bodily nutrition. In proof that there is a marked difference between voluntary and involuntary work, we need only compare the mechanical action of the heart, which never causes fatigue, with that of the voluntary muscles, which become fatigued by continued exertion.

The address, taken as a whole, is a masterly review of the present status of chemistry; and as we look back for fifty years, and see the wonderful progress since those days, we can look forward with the most hopeful anticipations as to what may be accomplished before the next half-century of time is passed. It would be idle to speculate as to what the future may bring forth; but we are confident that those chemists who are living in the year 1937, will see a much greater advance in both chemistry and general science than we at the present day can observe since the times of John Dalton and Humphry Davy.

WHO SHOULD STUDY CHEMISTRY.

The selection given below appears as an editorial in a recent number of the London *Chemical News*, and is, presumably, from the pen of Dr. William Crookes, one of the most distinguished chemists in England. Although it is especially addressed to English students, it is equally applicable to those in this country, with the possible exception of the considerations mentioned in the last paragraph. Still, even in the United States the number of competent chemists is very large, and the demand for their services small; and as a means of obtaining a competence, or even a living, there are many other occupations which offer a much more brilliant outlook to any one making a choice of an occupation.

The facilities for the study of chemistry are becoming more abundant, and, in some respects at least, more efficient. There is even a possibility that at no distant date these opportunities will be still farther extended, and that "chemistry for the million" will become a serious fact. But we cannot advise the young to avail themselves of the facilities offered without making certain reservations. We must ask the student — or, rather, prompt him to ask himself — what are his motives and aims in taking up the pursuit of chemistry, and not to be content without a definite answer.

If his purpose is mental cultivation, if he seeks to acquire the power of learning from things, of cross-questioning nature, or, as it might be put, of observing accurately, and drawing correct conclusions from his observations, we bid him go on and prosper. He will find chemistry an excellent — under many circumstances perhaps the most excellent — discipline for attaining this end.

Or, if he is born to an independent position, and, possessing good abilities, purposes devoting his life to research, we would still more strongly encourage him to persevere. There is an endless quantity of work not directly remunerative, but of the highest importance, which requires to be done. Such work requires an unlimited command of time, and can therefore be undertaken only by persons in the position we have just mentioned. For these persons to embark in business is simply high treason against science and against the progress of the human race.

Or, again, a young man may have before him the prospect of succeeding to the proprietorship of, or a share in, a brewery, a print-works, an alkali-works, or some other of the many kinds of industrial establishments which depend more or less upon chemical principles for their success. It is surely not needful to explain that in all these cases common prudence will make the acquisition of sound chemical knowledge imperative. To all such persons we should recommend not merely to aim at a special knowledge of some one part of the science which bears most directly upon their intended calling, but rather, and as a groundwork, a sound general mastery of the entire science, upon which a more special and minute insight into their own department may be superinduced.

There are, again, professions in which a knowledge of chemistry is necessary. This has long been recognized with regard to medical men. The more clearly the processes, healthy or morbid, observed in the living body are understood, the more does the physician who is not a chemist feel himself at a loss.

To a less though an increasing extent is this the case with the legal profession. We shall not be accused of acting on the "nothing like leather" principle, if we recommend the study of chemistry to incipient solicitors and barristers. Questions concerning the validity of patents, concerning adulterations, nuisances, poisoning, etc., come before the courts often enough to render chemical knowledge useful to the lawyer.

The schoolmaster is in these days often expected to teach chemistry, and he will, as a rule, not succeed in teaching what he has never learnt.

To all these different classes of persons we can give our heartiest encouragement. But there is another class, and we have every reason to fear a numerous one, to whom we can only say, "Refrain!" At one time it seemed likely that there might spring up a profession by means of which chemists would be able to earn a respectable livelihood by the practice of analysis, and by undertaking chemical investigations. From a variety of causes this prospect has proved a mere illusion. Chemists have been trained in such numbers that the supply exceeds the demand; and, in addition, there is the constant influx of foreigners, who sometimes offer their services gratuitously for half a year or more. In fact, really well-trained chemists, except they possess a practical knowledge of some one or other of the chemical arts, or enjoy special influence, are a drug in the market. The consequence is, that these gentlemen have to put up with rates of payment below that of average workingmen. It is truly painful to us to read over the numerous letters which we receive asking for advice or recommendation. The writers can often produce excellent certificates, but there is no demand for their services. We are compelled, therefore, to advise young men to think twice before entering upon the study of chemistry as a profession.

[Specially reported for the *Popular Science News* from the Observatory of the College of New Jersey.]

ASTRONOMICAL PHENOMENA FOR NOVEMBER, 1887.

Mercury at the beginning of the month is an evening star, but is too far south of the Sun to be easily seen. It passes inferior conjunction with the Sun on Nov. 17, and becomes a morning star, rising at the end of the month about an hour and a half before the Sun, and a little to the north. Venus is a morning star, rising about three hours before the Sun. It will reach its greatest elongation west of the sun on Dec. 2, when the two bodies will be a little less than 47° apart. Mars is a morning star, and rises between 1 and 2 A.M. It is gradually growing brighter, and may be found at the beginning of the month about 15° above and to the north of Venus. By the end of the month the distance will be about one-half greater. On Nov. 25 it approaches quite near to the third-magnitude star *Beta* Virginis, the planet being about 80′ south. Jupiter passes conjunction with the Sun on Nov. 8, and is not in good position for observation during the month. By Nov. 30 it will rise about an hour

before the Sun. Saturn is nearly stationary among the stars, moving slowly eastward until Nov. 17; then it begins its retrograde motion, but the whole motion is only about one-half of the Moon's diameter. It is still about 18° south and east of Castor and Pollux (*Alpha* and *Beta* Geminorum), and during the whole month will be very near and a little to the west of the fourth-magnitude star *Delta* Cancri. It rises at about 11 P.M. on Nov. 1, and at about 9 P.M. on Nov. 30. Saturn, Regulus (*Alpha* Leonis), Mars, and Venus lie nearly in a straight line at the beginning of the month. The distance of Saturn from Regulus is about 22°, Regulus to Mars about 13°, and Mars to Venus about 14°. Uranus is a morning star, and is about 1 degree south of Venus on Nov. 23. Neptune is in opposition on Nov. 20.

M.

Princeton, N.J., *Oct.* 4, 1887.

[Specially reported for the *Popular Science News.*]

METEOROLOGY FOR SEPTEMBER, 1887.

TEMPERATURE.

Average Thermometer.	Lowest.	Highest.	Range.
At 7 A.M.	51.70°	35°	66°	31°
At 2 P.M.	65.70°	54°	78°	24°
At 9 P.M.	54.67°	39°	66°	27°
Whole month	57.36°	35°	78°	43°
Second average	56.68°	35°	78°	43°
Last seventeen Sept's	61.42°	57.36°, in 1887.	66.69°, in 1881.	9.33°
Second average	60.70°	56.68°	66.12°	9.44°

In the last report, for August, that month was found to be the coolest August, with one exception, in seventeen years. The present September is found to be the coolest, without an exception, in that time. Two unusually cool months coming together at this season of the year, must have an influence on the vegetable world. The 26th was the coolest day, with an average of 44⅔°; the 7th was the warmest, at 70°. The lowest point reached at the hour of observation was 35°, on the 27th, and the highest 78°, on the 7th. The four coolest consecutive days (24th-27th) averaged only 45⅓, attended with slight frosts; the four warmest (4th-7th) averaged 65⅚°. The last half of the month rose above 67° but twice, and the entire month was 4.07° below the average for seventeen years.

SKY.

The face of the sky in 90 observations gave 54 fair, 15 cloudy, 19 overcast, and 2 rainy, — a percentage of 60 fair. The average fair in September in seventeen years has been 60.3, with extremes of 35.5, in 1882, and 77.7, in 1871. The mornings of the 5th and 29th were foggy. Several days were noted very fine. The evening of the 25th exhibited a beautiful "aurora borealis." The 26th and 27th were distinguished by a red sun, caused, probably, by smoke from fires in Canada.

RAIN.

The amount of rainfall the past month was only .98 inch, while the average for the last nineteen Septembers has been 2.50 inches, with extremes of .45, in 1877, and 9.30, in 1882. The small amount of rain fell principally on four days, between the 7th and 13th, with thunder and lightning on the 7th. The amount of rain since Jan. 1 has been 35.43 inches, while the average for these nine months in nineteen years has been 33.88.

PRESSURE.

The average barometer the last month was 30.110 inches, with extremes of 29.55, on the 7th, and 30.33, on the 18th, — a range of .78 inch. The average pressure of the last fourteen Septembers has been 30.021 inches, with extremes of 29.915, in 1876, and 30.110, in 1887. September thus continues the banner month for high pressure, the average having been over 30 inches twelve times in fifteen years. The sum of the daily variations the past month was 3.93 inches, — an average daily movement of .131 inch. This average in fourteen Septembers has been .127, with extremes of .074 and .166. The largest daily movements were .38, on the 8th, .37, on the 22d, and .30, on the 6th and 7th, all in near connection with rainfall. Full one-fourth the observations were noted stationary, indicating unusual steady, uniform weather.

WINDS.

The direction of the wind in 90 observations gave 16 N., 0 S., 3 E., 26 W., 11 N.E., 15 N.W., 3 S.E., and 16 S.W., — an excess of 23 northerly and 40 westerly over the southerly and easterly, and indicating the approximate average direction to have been W. 29° 54′ N. The westerly winds in September have, with one exception, in eighteen years prevailed over the easterly by an average of 26.28 observations, while the northerly and southerly have almost exactly balanced; indicating the general average direction to be very nearly due west. The longitudinal extremes during this period have been 2 E., in 1874, and 56 W., in 1880, — a range of 58 observations; and the latitudinal 23 N., in 1887, and 31 S, in 1880, — a range of 54. The relative progressive distance travelled by the wind the past month was 46.64 units, and during the last eighteen Septembers 473 such units, — an average of 26.28; showing less opposing winds the present September than usual. By the above it appears that the wind averaged the last month nearly three points of the compass more northerly than usual, and is, doubtless, one principal cause why the month was so unusually cool. The colder months all average more or less strongly a northerly direction of the wind, and the warmer a southerly direction.

D. W.

Natick, *Oct.* 6, 1887.

QUESTIONS AND ANSWERS.

Letters of inquiry should enclose a two-cent stamp, as well as the name and address of the writer, which will not be published.

Questions regarding the treatment of diseases cannot be answered in this column.

E. M. J., *Arizona.* — Does the long-continued passage of an electric current through a wire injure or change the metal in any way?

Answer. — There is no evidence that the electric current has any effect at all upon the conductor, unless it has so high a resistance that it becomes heated or melted. When properly adjusted to the strength of the current, it may be used indefinitely without alteration.

H. R. B., *Albany.* — How long would a young man have to study to obtain a complete knowledge of chemistry?

Answer. — The course in the best scientific schools is four years, and an extra year or two can be spent to good advantage either in taking an advanced course or in practical work in a laboratory. This last would be of the highest value, as one can obtain knowledge in this way that no strictly educational institution can impart.

F. S., *Springfield.* — There is no truth in the statement, so often made, that sleeping in the moonlight causes insanity; neither do the lunar rays have the slightest effect in causing dead fish to become putrid.

F. B. I., *Ohio.* — By looking at the planet Jupiter in a mirror, I can plainly see the moons alongside of the image of the planet. How can the mirror magnify to such an extent?

Answer. — The so-called "moons" are only multiple reflections of the planet itself from the front and back surfaces of the glass. Try the experiment with a bright fixed star or a distant street-light, and the same multiple image will appear.

A. T., *New York.* — What is the rate of expansion of illuminating gas when heated?

Answer. — The coefficient of expansion of all gases is .00366, or $\frac{1}{273.5}$ of their volume for each Centigrade degree. The following formula will answer for nearly every case: $V' = V\,1 + (.00366\ t'-t)$, where V equals the original volume, V' the volume at the new temperature, t the original temperature in Centigrade degrees, and t' the new temperature.

C. L. — How can I separate the tannin from gelatine after they have combined to produce a leathery substance?

Answer. — There is no practical way of doing this. Such a process would be a very valuable one, as it would enable us to utilize leather scraps to much better advantage than at present.

Teacher. — I dissolved resin in alcohol, and, on adding water, obtained a milky precipitate. How shall I explain this to my scholars?

Answer. — The precipitate is simply finely divided resin, which is insoluble in water or dilute alcohol, and was therefore precipitated when the solution was mixed with water.

D. E. C., *Mass.* — What is the cause of the apparent difference in the size of the moon as viewed by different persons?

Answer. — The disk of the moon being removed from all terrestrial objects, we have no means of judging of its size by comparison with those of known magnitudes, and the eye unconsciously gives it a greater diameter than an actual measurement would indicate. The same illusion is observed in looking at the moon through a telescope, when the magnified image appears smaller than when seen by the naked eye. See article "Optical Illusions" in the *News* of July, 1887.

LITERARY NOTES.

The Science of Thought. By F. Max Müller. 2 vols. 8vo. Price per volume, $2.00. Charles Scribner's Sons, publishers, New York.

This latest work of the eminent philologist is said by the author, in his preface, to be written "for myself and a few friends with whom I have been travelling for many years, on the same road." But we think that the number who will read it with pleasure and profit will be much larger than the above statement assumes. It is largely devoted to the philosophy of language, and is written with true German thoroughness. In the chapter upon "Language the Barrier between Man and Beast" the Darwinian theory is discussed at much length, and rather sharply criticised. The work, while not strictly a popular one, is a valuable contribution to science, and will be read and studied with interest not only by the philologist, but by the naturalist and philosopher as well.

The Earth in Space: a Manual of Astronomical Geography. By Edward P. Jackson, A.M. D. C. Heath & Co., publishers, Boston.

This is an excellent little "science-primer," designed for the use of grammar and high schools, in courses where the time that can be devoted to the study is limited. The fundamental principles of the science are clearly explained; and the mathematical part is not neglected, although it is so simplified that it can easily be understood by any one. The illustrations are unusually good.

Strength, compactness, convenience, and durability are the essential qualities which a good visiting-list should possess to resist the unusual hard wear it receives. These qualities are all combined in *Lindsay & Blakiston's Physician's Visiting-List*, which has now been published for thirty-seven years. It is the most convenient for the pocket. Its contents are arranged in the most advantageous way, and include many useful tables and much specific information.

No better evidence of the practical worth of this book can be offered than the uniform popularity it has enjoyed, notwithstanding the competition of various imitations published during the past few years. Price from $1.00 to $3.00 according to size. P. Blakiston, Son, & Co., Philadelphia, publishers.

Pamphlets, etc., received: *Transactions of the Scientific Section of the Vassar Brothers' Institute, Poughkeepsie, N.Y.*; *Incised Bowlders in the Upper Minnesota Valley*, by T. H. Lewis, St. Paul, Minn.; *The Rice Electric Railway System*; *Announcement of the Hospital College of Medicine and the College of Dentistry of Louisville, Ky.*; and the *Reports of the New Jersey Agricultural Experiment-Station and the Rhode Island State Board of Health.*

Medicine and Pharmacy.

[Original in the *Popular Science News*.]

SANITARY SCIENCE AND DOMESTIC ARCHITECTURE.

BY JOHN CROWELL, M.D.

I.

In erecting a dwelling-house, the location is of primary importance. A dry cellar is more essential than all the fancies of modern architects, and good ventilation and secure plumbing should take the precedence of pretentious cupolas or spacious corridors. In selecting a lot, reference should be had to the nature of the soil and the condition of the watershed. A clayey soil is always difficult to deal with, as the moisture is held by the clay, and a cellar is almost always damp in spite of all precautions. Still, a clay soil, by thorough drainage, secure cellar walls, a thoroughly cemented bottom, and free ventilation, can be made comparatively safe.

In laying a cellar wall in a damp locality, care should be taken to build the outside of the structure in smooth finisb. This can be done by building the wall a few feet within the line of excavation, thus leaving a space for thorough work. If the jagged points of stone project into the earth, they invite moisture, and in a very wet season the cellar wall will surely be damp. The space thus left should be filled with gravel slightly mixed with loam or sand. Granite is the best stone with which to build a cellar wall, as it is nearly impervious to water, and some slates and limestones are nearly as water-proof. If the soil be very springy, dampness can be obviated in some measure by a drain of loose stones or an open-jointed drain-pipe placed two or three feet below the surface. In cementing tbe cellar, it is safe to have a drain four inches wide and three inches in depth built near the edge of the wall, to arrest and carry off any water that may by chance work through tbe wall. Of course, in entering the cellar drainage into the main sewer, great care should be taken to protect against tbe entrance of sewer gas or odors by means of trapping, and a ventilating pipe placed at some distance from the house.

Having secured a good location and a safe cellar, the vital conditions are essentially met in commencing the erection of the main structure. Sunny exposure, abundance of ligbt and air, and good ventilation, cover the main sanitary conditions. But it is more easy to theorize about ventilation than to secure its practical working. Indirect radiation from steam or hot-water pipes, where the air is taken pure and fresh from the outside of the house, serves well for ventilation if there are open fireplaces in the rooms. Direct radiation from heated steam-pipes, with no ingress of fresh air, is a very unsatisfactory mode of heating and ventilating. If the register of a hot-air furnace, or a steam radiator be near the fireplace, of course the circulation will be facilitated and the ventilation be made more complete. In our New-England climate the external air finds easy access through the numerous crevices of the ordinary house, and many are satisfied with this mode of ventilation. Others prefer to stop every crack by double windows and listing, and regulate the cold air by some mechanical appliance; and any system that will let the pure air *in*, and drive tbe foul air *out*, without causing an uncomfortable draught, is worthy of attention.

Great care should be exercised in keeping the surroundings of the house free from all sources of uncleanness. It is not enough that the inside of a dwelling be kept clean: the back-yards and alleyways must be sharply inspected, and be free from polluting heaps of filth. A cesspool or a privy is a dangerous foe to cleanliness, and their condition cannot be too carefully watched. If a privy join the house, it is next to impossible to prevent the foul odors from penetrating the rooms. A privy-vault or cesspool, to be decent, must be often disinfected and cleansed, and the contents carried from the premises for utilization. Many processes have been devised for the disposal of sewage in country houses where there is no system of drainage. Perhaps the most satisfactory method is that obtained by tile drains distributed beneath the soil, so laid as to a limit of the absorption of the sewage flowing from the cesspool. The advantage of pipes placed in this way lies in tbe avoidance of clogging the ground with filth; for the decomposition of the organic portions of the sewage so close to the surface goes on continually, and frequent change in the absorption in the ground is obviated. Such construction needs frequent examination, for there is always danger of clogging with sediment; and to insure safety, it is well to give thorough inspection before the freezing of the ground. It is hardly needful to add, that every entrance from the house to a cesspool should be securely trapped and ventilated.

In cities where there is a system for the disposal of sewage, with an abundant water-supply, the sanitary arrangements become simplified, requiring only the best of plumbing to insure safety from any of the evils of filth or sewer gas. In no department of house-building has there been more intelligent improvement than in the methods adopted for house-drainage under the guidance of scientific oversight.

In every well-appointed dwelling the old pan-hopper and siphon trap are discarded as filthy and unsafe, and the various fancy trappings of chains, plungers, and overflow strainers are displaced by more simple and cleanly appliances. The costly cabinet work that once surrounded sinks, closets, and bath-tubs, is considered not only unnecessary, but objectionable, as an accumulator of filth, and a lodging-place for vermin. The open finish, leaving the plumbing largely exposed, has come into general use in all large, first-class establishments; and with the handsome nickel-plated finish and excellent workmanship of the plumbing, the finest rooms may be made ornamental by tbe use of these fixtures. That accomplished architect, J. Pickering Putnam of Boston, lays down the following fundamental principles for the guidance of sanitary engineers in the construction of apparatus for water-carriage: —

1. A round *water seal* alone should be used for trapping. All mechanical devices, as valves, balls, and plungers, should be avoided.

2. The waste matters should be *completely removed* from the dwelling automatically the instant they are formed.

3. The main drain and soil-pipe should be thoroughly *ventilated* from end to end.

4. The entire system of waste-pipes and receptacles should be thoroughly *flushed* from end to end.

5. The entire system of plumbing sbould be directly *visible* and *accessible* from end to end.

6. All materials used should be *sound* and *durable*, and they should be jointed in such a manner as to render the whole work permanently *air and water tight*.

7. Of two methods or devices otherwise equally good, preference should always be given to the *simpler*.

8. Of two methods or devices otherwise equally good, preference should always be given to the more *economical in construction and operation*.

9. All working parts of the system should be, as far as possible, *automatic*.

10. The operation of all parts of the work sbould be, as far as possible, *noiseless*.

These ten broad principles are now accepted by plumbers as axioms established by the authority of all leading sanitarians.

It is more than folly to attempt to erect a dwelling without observing them. They are of vital moment to the safety of the loved ones who are to occupy the home; and, cost what they may, they must not be omitted for the sake of the show of pretentious architecture. With these wise and safe beginnings, we are prepared to consider the construction of the house, which will be the subject of another article.

HAVERHILL, MASS., *September*, 1887.

[Specially compiled for the *Popular Science News*.]

MONTHLY SUMMARY OF MEDICAL PROGRESS.

BY W. S. WELLS, M.D.

DR. COLLIGNON communicates to the *Journal de Med. et de Chir. Pratiques* a singular condition of muscular atrophy, resulting from the prolonged application of blisters to the arms, in the person of himself.

The doctor states, that, when he was five years old, he suffered from obstinate cerato-conjunctivitis, following scarlatina. Other means of relief having failed, the physician advised the application of large blisters to the arms, and these were not allowed to heal for a period of eighteen months. The result of this prolonged counter-irritation was atrophy of the muscles of both arms. The doctor writes that he is otherwise of fair physical development; but the muscles of the upper extremities between the shoulders and elbows are small in size, and weak as compared with others.

This is an instructive case, and should warn against similar practice, lest, as in this instance, permanent injury should result.

DR. T. H. BICKERTON, at tbe Liverpool Medical Association, called attention to the frequency of headaches from errors of refraction.

This condition often causes headache more or less severe, intermittent or constant, and in some cases associated with indigestion, biliousness, and vomiting, in some with giddiness and faintness, and in others with languor, sleeplessness, and general debility. The doctor has seen not only the headache, but all its varied concomitants, vanish by means of accurately fitted eye-glasses or spectacles, and therefore concludes that errors of the refractive media of the eye are responsible for a large number of headaches and their frequently associated gastric and circulatory disturbances, — a much larger minority than the profession have heretofore accredited to the source named. Hence the importance of ocular examinations in these cases.

M. GRANDELMENT of Lyons (*Le Concours Med.*) shows, as a companion-piece to the above, that many visual troubles are of dyspeptic origin, and not due to anomalies of refraction. There will be found some defective condition of the digestive functions, — a dyspepsia more or less chronic, and sometimes also a fault of nutrition, causing excess of phosphates, glycosuria, etc. The visual defects observed from faulty assimilation of the food, and tbe consequent sympathetic neuroses arising from tbe formation of toxic alkaloids or ptomaines, consist in a diffused pain of the globe, radiating toward the temples, the forehead, and even the scalp. There is a hyperæsthesia of the retina, with photopbobia and photopsia, following

the exercise of accommodation. Other patients complain of *scotomæ* (darkness), *hemianopsia* (half-sight), *diplopia* (doubled objects), and *mouches volantes* (moving objects).

All of these ocular neuropathies may be cured, or at least greatly ameliorated, by careful attention to dietetics and hygiene, and by the persistent use of moderate doses of saline laxatives and alkalies.

In severe cases, flushing the stomach, rest in bed, and the use of a hypogastric girdle to sustain the dilated stomach and intestines, are recommended.

Dr. Hausman (*British Med. Jour.*) prescribes subcutaneous injections of atropine in serious cases of hæmoptysis. He reports several cases in which this remedy produced excellent results after the administration of terpentine and hypodermics of ergotine had produced no improvement. In most of his cases not more than two injections of three milligrams of sulphate of atropine were required to arrest the hemorrhage.

At the Academie de Medécine, Bourneville (*Le Progres Med.*), Professor Hayem read a paper on "Dyspepsia of Infants" and the microbic nature of green diarrhœa. As a prophylactic, he advises instant removal of the soiled linen with green stools, and washing it in a one per cent solution of corrosive sublimate.

Internally he finds lactic acid the best medicament to destroy the bacilli, and gives seven or eight grains in divided doses daily, until the green hue of the discharges is supplanted by the yellow.

Dr. Tausini (*Gaz. degli Osp.*) reports the treatment of a case of lupus of the nose and face by means of repeated injections of corrosive sublimate. He began with a solution of one to two hundred; but, as this produced no effect, a stronger solution of one to one hundred was then used This produced some tumefaction and œdema in the neighborhood of the punctures, and some slight suppuration. Improvement followed the successive injections, amounting to fifteen in all, of a few drops each; and eventually all traces of the disease disappeared, the only marks left being those of the punctures in which suppuration had occurred. Tausini claims advantages from this method on account of lessened pain and disturbance, and superior cosmetic results.

Professor Lashkevitch of Russia states (*British Med. Jour.*) that cyanide of zinc has a peculiarly beneficial action in cases of palpitation and pain in the region of the heart, with want of proper rythm, both when valvular disease is present, and also when the symptoms depend on some neurosis. It is more marked in its action in the latter case. Cyanide of zinc has shown itself particularly valuable in cases where digitalis, convallaria, and other drugs commonly prescribed in cardiac affections, appear to irritate the abdominal viscera. The dose is one-tenth to one-eighth of a grain, and this quantity is usually prescribed three times a day.

A substance in use among photographers, known as photoxylin, has been used by Professor Wahl, St. Petersburg, as a substitute for collodion in surgical cases (*Lancet*). A five per cent solution, in equal parts of alcohol and ether, he finds preferable to collodion, as it adheres more firmly to the skin, and is not so easily removed by washing. It is said to be absolutely impervious to liquids, and exerts a perfectly even compression on the parts. The professor carefully closes the wound, after arresting hemorrhage, with sutures and gelatine plaster, and then covers the whole with a thin layer of wool soaked in the solution of photoxylin. This, it is stated, will remain eight or ten days, entirely resisting all moisture.

Schulz and Strubing (*Deutsche Med. Woch.*) recognize three forms of chlorosis, which they distinguish therapeutically: 1st, that which disappears on the simple treatment of an imperfect digestion; 2d, that for which the use of iron is needed; 3d, that which is unimproved or aggravated by administering iron. For this form they employ sulphur, and report, that, in cases of pure chlorosis in which iron was without effect, the general condition was greatly improved by the use of sulphur.

M. Renault has communicated to the Clinical Society of Paris an article on the use of benzoate of soda in affections of the pharynx and larynx. Three cases were cured rapidly under the influence of the benzoate in the dose of six grams a day, in broken doses of fifty centigrams at a time. M. Renault prefers to use the salt obtained by the aid of benzoic acid prepared from benzoin, and not that made from the chloride of benzole.

Dr. Illingworth (*Provincial Med. Jour.*) reports that he has used injections of carbolized water with great success in diarrhœa. He gives one ounce of the "one-in-twenty" carbolic solution, and directs that it shall be added to a teacupful of warm water, to be used as an enema. This should be retained; and in his experience he has never yet had to repeat the injection, although he has used it in scores of cases during an epidemic of choleraic diarrhœa. The addition of minim or two-minim doses of carbolic acid to ordinary diarrhœa mixtures for internal administration, is also of great service in effecting rapid cures in this complaint.

M. Abadil recommends three per cent solution of boracic acid, frequently applied, for the cure of styes.

[Original in *Popular Science News.*]

ACNE PUNCTATA AND KINDRED AFFECTIONS.

A healthy integument is not necessarily beautiful. All the requirements concerning diet, residence, atmospheric and climatic conditions, etc., may be carried out, and still the complexion is often very bad. The general condition of health has very little influence upon the beauty of the complexion, though it has upon the *health* of the *skin*. A person may possess a beautiful complexion, and yet the integument may be unhealthy.

It is very common to find, on the face and shoulders of young people about or above the age of puberty, numerous black spots imbedded in the skin, and resembling small grains of gunpowder. Very often these spots occur in the centre of small yellowish or whitish elevations. These spots, which characterize the disease known as *acne punctata*, are due to the retention of sebaceous matter, and, being caused by a disorder of the sebaceous glands, are observed chiefly on the face, and especially on the forehead and the alæ of the nose, which are particularly rich in these glands; still, they are common on the pinna of the ear, the neck, the chest, and back.

If the skin on either side of one of the follicles be firmly compressed, a consistent filiform white or yellowish substance with a black head comes out. Owing to its size and shape, and the black point at its extremity, where it has been exposed to the action of the atmosphere, it bears resemblance to a small maggot, hence it is popularly termed the "flesh-worm" or "skin-maggot." These names are calculated to convey the erroneous idea that the small inspissated plug of altered sebum is actually a parasitic worm. In the mass of sebaceous matter, however, is often found an actual epizoon. This animalcule is very small, being in length from a two-hundredth to a hundredth of an inch, and in breadth about a six-hundredth of an inch, and is termed by Einsecht the *steatozoön folliculorum*, and by Wilson *demodex folliculorum*. It may be made apparent under the microscope by diluting the sebaceous matter with warm olive-oil. The presence of this parasite, however, is without significance, and it is undoubtedly perfectly harmless and entirely innocent of the disease, since a number may be found in a single plug, while again several masses may be examined without finding one.

Acne punctata is very often accompanied with a shining, greasy condition of the neighboring skin.

Acne punctata differs from *acne sebacea* in the fact that in the latter the sebum is fluid and oily, and runs freely from the follicle, while in the former it possesses much greater consistence, and is retained in the follicle, which it either gradually distends or irritates up to the point of inflammation, producing *acne simplex*.

The causes of *acne* are found in a lowered vitality, generally associated with constipation and assimilative disorders, and in females with sexual disturbances. All forms of *acne* generally improve after marriage, although quite severe cases have occurred in those who are married and have had children.

The treatment of *acne punctata* is the same as that of ordinary *acne*, and calls for internal and external remedies. In *punctata* the contents of the gland should be pressed out. This may be effected by squeezing the skin on either side of the follicle between the nails, or more readily with the aid of a watch-key, or, still better, with a little instrument which has been devised for the purpose. The constitutional treatment includes diet, hygiene, and internal medication. Attention must be paid to the general health, and any bad habits that exist should be broken up. Certain articles of food almost invariably produce *acne* in some individuals, and consequently many of the so-called luxuries of life should be abstained from; among these are wines and beer, also sweet and rich articles of food. Exercise is all-important, and the proper care of the skin by bathing and otherwise must never be neglected. The extrusion of the sebum plugs should be accomplished as thoroughly as possible, and the face (excepting the eyes) daily washed with water containing about two teaspoonfuls of aqua ammonia. Good soap and water should be applied freely, while it should never be forgotten that water is serviceable to the skin only in moderate amounts and at moderate temperatures.

There is no one internal remedy which will have any great and permanent effect upon all cases of *acne*. Mineral waters are especially beneficial in many cases. Still, the measures to be used are those directed principally to the restoration of perfect health, and to the removal of assimilative and nutritive debility, often manifested by constipation, dyspepsia, and sexual disturbances.

J. H. E.

CHLOROFORMING PERSONS WHILE ASLEEP.

The victims of chloroform at the hands of burglars are usually, at the time, in good health. The more improbable, then, is the story usually told of such burglaries; and, in view of the exceptional instances in which healthy individuals can be chloroformed during sleep, the anæsthetization of a whole family becomes still more improbable. Indeed, we cannot reconcile with our knowledge of the action

of chloroform all the newspaper accounts we have read of how burglars anæsthetize a whole family, and then proceed to plunder. Every link in the chain of such a story is made of only a bare possibility.

Under all conditions anæsthesia by chloroform can be accomplished during sleep only by skilful administration. Overdosage at the outset will certainly awaken the sleeper. Only by very gradual administration can the anæsthesia be accomplished. We doubt the ability of burglars to force the anæsthesia of several or more persons sleeping in the same room, without raising an alarm.

An impression prevails that burglars usually proceed by impregnating the air of an apartment with chloroform vapor, so as to gradually anæsthetize all the sleepers at the same time. The weight of chloroform vapor, and the readiness with which it descends, make it difficult to saturate the air of a sleeping apartment, especially one at the time well ventilated. Besides, the quantity of chloroform necessary to saturate the air sufficiently to produce anæsthesia is very considerable. Allowing one and a half grains of chloroform to the cubic inch of air, it would require thirty-eight fluid ounces of chloroform to sufficiently impregnate the air of a room ten by twelve feet, with a ceiling eight feet high. It would certainly take a considerable time to vaporize this quantity of chloroform, to say nothing of the probability of awakening sleepers by any process of atomization. Even if the saturation of the air of a room were possible by any process without awakening the sleepers, what would protect the burglars themselves from the all-pervading soporific influence? Burglars are seldom bunglers, and their operations are usually conducted with too much intelligence for us to believe that they often waste their time and increase the risks of detection by attempting to chloroform peaceful slumberers.

In all the published accounts of robberies committed in the presence of persons said to be asleep under the influence of chloroform, which have occurred in our reading, the burglars have always been successful, not only in pillaging the premises, but in chloroforming everybody in the way. Now, we cannot believe that burglars, who are supposed to be laymen, operating at night in the midst of many obstacles, and under circumstances calculated to be embarrassing in the event of detection, can usually accomplish in all, or nearly all, instances what skilful physicians accomplish with difficulty in exceptional cases, and that with all the circumstances favorable.

So we are obliged to give it as our opinion, that as a rule, with rare exceptions, the natural sleep of healthy adults is interrupted during chloroform anæsthesia, whatsoever the manner of administration; and we do not believe one-half of the stories about burglaries accomplished with the aid of chloroform. —*N. O. Med. and Surg. Jour.*

MEDICAL MEMORANDA.

THE DEATH-RATE of the earth is 67 a minute, 97,790 a day, and 35,639,835 a year; the birth-rate, 70 a minute, 100,800 a day, and 36,792,000 a year.

PROFESSOR ARLT, the famous oculist, has recently died in Vienna. He had a world-wide reputation as an operator in affections of the eye, and is said to have had no fewer than five thousand cases of cataract alone.

A BIT of soft paper is recommeuded by an English doctor for dropping medicines into the eye, as being equally effective as brushes, glass droppers, etc., and far less likely to introduce foreign substances

SALICYLIC ACID. — A report on the employment of salicylic acid in food has been presented by M. Vallin to the French Government, in which it is stated that the continuous taking of even small quantities of salicylic acid, or its derivatives, is injurious to health, especially in the case of aged persons, and those whose renal and digestive organs are not perfectly sound.

ICE-POULTICE. — Spread a layer of linseed meal three-fourths of an inch deep on a cloth of proper size, and put pieces of ice the size of a marble on the meal at intervals of an inch; then sprinkle lightly with the meal; cover with a cloth, and turn over the edges; apply the thick surface to the skin. The meal protects the skin, and excludes the air from the ice, thus preventing melting. — *Technics.*

A NEW FORM OF ANGLOMANIA. — The craze for obstructing research, on the grounds of cruelty to animals, is crossing the ocean and afflicting our own shores. Dr. Leo Sommer, although having the sanction of the Mayor and Board of Health to experiment upon the dogs in the New-York City Pound with hydrophobic inoculation, was prevented from so doing by the agents of the Society for the Prevention of Cruelty to Animals. We must be anglomaniacs, even in respect to dogs.

ALL THE CONDUCTORS on the Maine Central Railway have been provided by the management of the road with cases containing remedies to be used in cases of accident, such as linen and rubber bandages, plaster, surgical instruments, medicines, liniments, etc , with books of directions. Every conductor will be his own doctor. The occasions are frequent also, in times of accident, when physicians are passengers upon trains; but they are often handicapped by lack of proper instruments. A further step in the right direction would be, to have all train-hands and employees instructed in "aid to the injured."

AN EASY METHOD OF PREVENTING SEA-SICKNESS. — Professor William James writes to the *Boston Medical and Surgical Journal*, suggesting that by counter-irritation over the mastoid processes, sea-sickness may be prevented. He was led to this idea by his experiments with deaf-mutes, whom he found to be singularly exempt from sea-sickness. In his own case, Professor James thinks that he prevented an attack by simply using frictiou over the mastoid processes.

HUMORS.

EXPERIENCE. — Young student physician (to charity patient): "I — I think you must have a — a — some kind of a — a fever; but — our class has only gone as far as convulsions. I'll come in again in a week."

THE *Chicago News* says that down in a Georgia county they use an old hearse for peddling the small green apples and peaches which retail at about the rate of ten for a nickel. And so the eternal fitness of things is again illustrated.

MANY of the drug-stores located in small places, handle water-melons, with a profit, not ouly on the fruit, but also on the medicine bought to counteract the effects they produce.

AN ATTRACTIVE STREAM. — During the year 1886 the following dead animals were removed from the River Seine at Paris: 2,021 dogs, 977 cats, 2,257 rats, 507 chickens and ducks, 6,000 pounds of spoiled meat, 210 rabbits, 10 sheep, 2 colts, 66 sucking-pigs, 5 hogs, 27 geese, 27 turkeys, 2 calves, 3 monkeys, 8 goats, 1 serpent, 2 squirrels, 3 porcupines, 1 parrot, 609 other birds, 3 foxes, 130 pigeons, 3 peacocks, 1 seal, besides numerous human bodies. We should not advise visitors to Paris to patronize any of the numerous bathing establishments located on the banks of this populous river.

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ONE DOLLAR A YEAR, IN ADVANCE.

SETH C. BASSETT,
MANAGER.

Publishers' Column.

SEND to JAMES VICK, SEEDSMAN, Rochester, N.Y., for a catalogue of crocus, hyacinth, and tulip bulbs, and plants suitable for growing in the house in winter.

WANTED. — Copies of the *Popular Science News* of December, 1886. Persons having spare copies of this issue can exchange them for any other back number that they may desire.

THE attention of our readers is especially directed to the large number of scientific and literary works advertised in our columns the present month. The lists are worthy of a careful inspection, and during the coming months will be changed and enlarged to include all the latest publications.

BOVININE is a highly condensed and stimulating food, and in cases of acute illness and great debility, where the action of the stomach is weakened or partially destroyed, has been used with the most gratifying results. It is easily retained and assimilated, even in the most irritable conditions of the organ.

DR. JOHN TANNER of London says: "I am fully convinced that there is no other preparation that contains such nutritive properties for the rapid production of healthy structure in the child as Mellin's Food. I therefore always recommend it in preference to any other kind of diet."

PROFESSOR LOISETTE'S new system of memory training, taught by correspondence at 237 Fifth Avenue, New York, seems to supply a general want. He has had two classes at Yale of 200 each, 250 at Meriden, 300 at Norwich, 100 Columbia law-students, 400 at Wellesley College, and 400 at University of Pennsylvania, etc. Such patronage, and the indorsement of such men as Mark Twain, Dr. Buckley, Professor William R. Harper of Yale, etc., places the claim of Professor Loisette upon the highest ground.

HORSFORD'S ACID PHOSPHATE is a preparation of the phosphates of lime, magnesia, potash, and iron, with free phosphoric acid. It is made according to well-known scientific principles, under the personal supervision of Professor Horsford of Cambridge, and in such form as to be readily assimilated by the system. For the various disorders incident to wasted or prostrated energies, weakened vitality, exhaustion, headache, nervousness, dyspepsia, etc., it will be found incomparable; giving almost instantaneous relief, and producing refreshing, dreamless sleep. For sale by all druggists and dealers in medicine.

MONROE, LA., Sept. 13, 1886.

MR. DAVID BOYLE, *Chicago, Ill.*

Dear Sir, — The five-ton Ice Machine purchased of you in 1882 has given perfect satisfaction; it continues to run smoothly, turning out more than the guaranteed quantity of ice, and up to date has needed little or no repair. The machine is so perfectly and simply designed, that any one of ordinary ability can learn to successfully operate it in a week; such has been our experience. We have read about and have seen several new-style machines, but *believe yours is the best*, so far; and, as our little city continues to increase in population, should we need a machine of greater capacity, we will certainly order your machine.

Yours truly,
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CONTENTS.

FAMILIAR SCIENCE. — Tea-Poisoning 169
Simple Scientific Experiments 169
The Galioscope 170
Ancient Metal-Workers in the United States 170
On the Formation of River Terraces 171
Scientific Brevities 172

PRACTICAL CHEMISTRY AND THE ARTS. — The Aniline Colors 173
The Significance of a Sanitary Analysis of Water 173
The Solubility of Isomeric Organic Compounds 174
Railroad Notes 174
Industrial Memoranda 174

HOME, FARM, AND GARDEN. — The Chemistry of Artificial Light 175
The Mysteries of Plant-Growth 175
A New Honey-Plant 176
Household Hints 176
Gleanings 176

EDITORIAL. — Astrology in Shakespeare 177
The Largest Statue in the World 179
Astronomical Phenomena for December, 1887 179
Paris Letter 179
Berlin Letter 180
Meteorology for October, 1887 181
Questions and Answers 181
Literary Notes 181

MEDICINE AND PHARMACY. — Patent Medicines 182
Sanitary Science and Domestic Architecture 182
Monthly Summary of Medical Progress 183
Roman Fever 184
Medical Memoranda 184

PUBLISHERS' COLUMN 184

Familiar Science.

TEA-POISONING.

BY THE SENIOR EDITOR.

THE assertion that tea is a poison is regarded with incredulity by a majority of readers; and yet, it is true that tea has toxic properties as positive as are the juices of the poppy-plant or the alkaloidal principle of the nux vomica. All substances, vegetable or mineral, which injuriously disturb functional movements, or which retard or prevent metamorphosis of tissue, must be classified as poisons. The leaves and stems of the tea-plant cause the physical disturbances alluded to, and therefore it is a toxic agent, which is entitled to attention as such.

Poisons act in a variety of ways, some slowly and without producing pain; others act violently, and with speedy, fatal results. Infusions of tea-leaves have been used by hundreds of millions of people in all countries, for many centuries; and, inasmuch as we do not observe a very large number of clearly proved cases of acute poisoning, we must conclude that tea is characteristically a slow poison, and also that its influence is unlike in different individuals.

Tea-drinkers, as a class, express doubts as regards the correctness of alleged poisonous properties of tea. Numerous instances of individuals of this class have been noticed who were themselves suffering from tea-poisoning. Their nerves were in a deplorably abnormal condition, the heart and brain were functionally disturbed, and the sleep less in quantity and less refreshing than it should be. One's opinion of the physical disturbances which may be caused by rum, tobacco, or tea, are not worth much when the opinion comes from a victim of the excessive use of these agents.

The chemistry of the tea-plant is very well understood, as is also its physiological influence. Tea contains much tannin, and an alkaloidal principle which is remarkably akin to *cocaine*, the new agent concerning which much has been said in the public journals, notably during Gen. Grant's illness. Indeed, so remarkably analogous therapeutically are the leaves of the coca and tea plants, that some physicians use the strong infusions of both for the same illnesses, and without differing results.

Theine and *cocaine* both, when internally administered, produce exaltation of the nervous system and increased powers of physical endurance. The brain is largely influenced in its functions, and long periods of wakefulness are induced. Continued use of strong infusions of either coca or tea result in great disturbance of nervous centres and functional offices, and either will produce fatal results by persistent use of inordinate quantities.

A cup of tea as served at tea-tables contains usually but a trace of the alkaloidal principle, but infinitesimal quantities are capable of exerting baneful effects upon some tea-drinkers. The tannin found in tea does not differ from the agent found in oak and other barks which the tanners use to convert the raw hides of animals into leather. It is a powerful astringent, and consequently, taken internally, it is apt to produce constipation and its attendant evils. Confirmed tea-drinkers are usually troubled with constipated bowels, and hence with dyspepsia, the king of evils. Not all tea-drinkers are thus afflicted, but the number is by no means small. What really needs to be known is, the exact truth regarding the toxic properties of tea, and its physiological influence upon tea-drinkers, as they exist in every community. If tea were an active poison, and its use as a beverage was as widespread and common as it is known to be at present, it would be an agent as potent of evil as alcohol. The race could not bear up long under two such terrible agents in common use. Without a reform or general abandonment of their employment, mankind would soon cease to occupy our planet.

Tea is in no sense an evil corresponding with alcohol. Alcohol is the most dreadful offspring which chemistry has bequeathed to us; and the day when the vinous fermentative process was understood, and the still put into operation, was the darkest and most rueful day in the history of mankind. Tea, with its alkaloidal and other constituents, is a natural product; it is evolved through and by natural processes: alcohol is not, it is directly a product of art. It must not, however, be forgotten that a considerable number of deadly poisons, resulting from natural changes in vegetable organisms, may be easily pointed out by chemists, but we do not use any one of them as daily beverages.

Mild infusions of tea are undoubtedly serviceable to many, when not used to excess; and it may be further stated, that a cup or two of tea taken during the day, at meals, rarely influences unfavorably vital processes in any one, unless they be confirmed invalids. It is rather the abuse of tea, than its use, that causes serious physical evils. Four or six cups of tea taken during each twenty-four hours, will in time produce tea-poisoning and greater or less evil results.

Tea is well enough when its use is kept under absolute, intelligent control; but if it becomes master in any case, then it must be promptly abandoned, for danger attends the intemperate tea-drinker every hour of his or her life.

Those advanced in life crave the stimulating effects of tea, and it is well to use it in moderation; but the young should abstain from its use entirely. It is better for all that the appetite for tea be not awakened in early life, as great injury may thereby result.

SIMPLE SCIENTIFIC EXPERIMENTS.

A PRETTY illustration of the principle of

FIG. 1.

inertia can be shown by taking a peach or other soft, ripe fruit, and inserting a knife-

blade a short distance into the flesh. If a peach is the fruit selected, the edge of the knife should be in contact with that part of the stone where the two halves are joined together, forming an edge or angle. Then take another knife in the right hand, and with its back strike the first knife a sharp blow at a point as near the fruit as possible (Fig. 1). The shock of the blow, instead of pushing the fruit away, will drive the knife completely through it before the force can be transmitted to the fruit; and in the case of a peach the hard stone will usually be split in two. Only common, cheap knives should be used for this experiment, as they are liable to be broken or damaged.

TAKE a sharp-pointed knife with a heavy handle, and press it *lightly* into the woodwork of the frame of a door. By striking the frame a sharp blow with the fist, the jar will release the knife, which will fall perpendicularly to the floor; and if a walnut shell or other soft body is placed directly beneath it, it will be crushed by the force of the fall. Previous to placing the nutshell in position, the handle of the

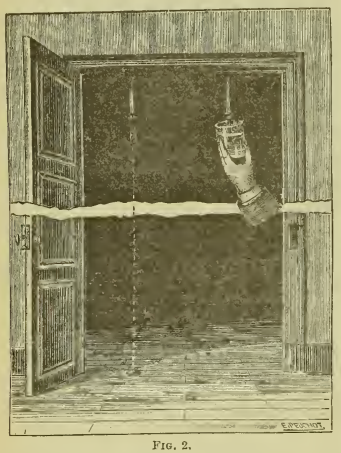


FIG. 2.

knife should be inserted in a glass of water (Fig. 2), when the falling drop, on reaching the floor, will indicate the exact spot where the nutshell should be placed.

This experiment also illustrates the principle of inertia, as the blow upon the framework of the door simply dislodges the knife before any motion is transmitted to it, as is proved by the fact that the knife falls perpendicularly in the same line as the drop of water falling from the handle. It also shows that light and heavy bodies both move in the same direction when acted upon by gravity.

IT is also true, that, if it were not for the resistance of the air, light and heavy bodies would fall with the same velocity. In the exhausted receiver of an air-pump a coin and a piece of paper fall from the top to the bottom in the same time. But this can also be shown without the aid of an air-pump, by cutting a circle of paper a little smaller than the coin, placing it upon the upper side, and allowing both to drop together from a horizontal position (Fig. 3). The paper is protected from

FIG. 3.

the action of the air by the coin, and both will reach the floor at the same moment. If, on the contrary, the coin and paper are separated from each other, and dropped at the

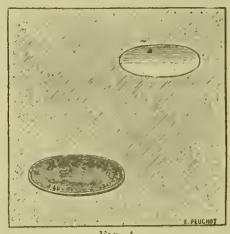


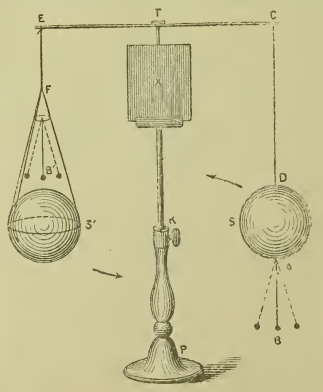
FIG. 4.

same time (Fig. 4), the lighter body will be retarded by the friction of the air, and will be much longer in reaching the floor than the heavier one.

The accompanying engravings are reproduced from *La Nature*.

THE GALIOSCOPE.

A FRENCH scientist, M. Boillot, has devised an apparatus for repeating Foucault's well-known pendulum experiment on a small scale, and showing, that, when an oscillating pendulum is attached to a revolving sphere, the plane of its oscillations preserves the same position independently of the rotation of the sphere to which it is attached. The construc-



tion of this simple and inexpensive apparatus is shown in the engraving.

Two light rubber balls, *S*, *S'*, about four inches in diameter, are suspended by threads, *D*, *F*, eight or nine inches long, to a horizontal rod, *EC*, about a foot in length. Two bullets, *B*, *B'*, are attached to the balls, one above and the other below, by threads three or four inches long, forming two little pendulums. The whole system is made to revolve horizontally by the clockwork, X, which can be improvised out of any old clock. It should be arranged so that a complete revolution will be made in five or ten minutes. If now the pendulums are set in motion, and the whole apparatus made to revolve around the axis, *TK*, it will be seen, that, whatever the position or movement of the larger balls, the pendulums will always vibrate in the same direction, unaffected by the motion of the spheres to which they are attached.

It will readily be understood, that, if one of the revolving spheres was indefinitely large, and the observer was placed upon it, and partook of its motion, the pendulum itself would seem to revolve, instead of the sphere. This is exactly what happens in the case of the earth. A pendulum swinging at the north or south pole would be moving in a plane perpendicular to that of the earth's rotation, and would apparently move entirely around a circle in the course of twenty-four hours, though really the pendulum would remain swinging in the same direction, while the earth and the observer would have moved around it. At the equator, however, the pendulum would be carried around with the earth, and its plane of vibration would always be in the same position as regarded the earth's movement, and therefore would not be observed to change its direction. At intermediate latitudes the direction of the pendulum's vibration would complete the circle more or less rapidly according to its proximity to the poles. At Paris, for instance, latitude 48° 50′ 49″, the time of a complete rotation of the vibrating plane of the pendulum would be 31*h*. 52*m*. 27*s*. This experiment has been practically tried, and the circular movement of the pendulum actually observed; and in this way we may say that we can "see the world move round."

[Original in *Popular Science News*.]

ANCIENT METAL-WORKERS IN THE UNITED STATES.

BY DR. D. G. BRINTON.

STUDENTS of ancient culture draw a sharp line between the "stone age" and the "metal age." The former includes that condition of development when stone is the sole material from which to form instruments with a cutting edge. But here, as so often elsewhere, we cannot draw a hard and fast line in evolution. For instance, the native tribes which inhabited the area of the United States at the epoch of the discovery were really in the "stone age;" but they knew and used quite a variety of metals.

We know more about this than about more important points in their arts, because it was the thirst for metals — precious metals — which inspired the earliest explorations. It was not the fabled "Fountain of Life" which attracted Ponce de Leon to Florida in 1512, so much as the gold and silver ornaments which earlier voyagers had

seen in the possession of the natives. They had little, it is true, and no mines were known in their own country; but when questioned as to its source, they pointed to the north, and told of a land whose warriors carried breastplates of gold and shields of silver, — a mountainous region, rich in mines. Such rumors as these prompted Fernando de Soto to his ill-starred expedition. His failure did not dispel the illusion, and long afterwards the Spanish sailors talked about "a very rich and exceeding great city, called La Gran Copal," somewhere in the Southern Appalachian Mountains.

Where they obtained this name we cannot guess; but that there was some substratum for the story, we now know, from the modern explorations of the gold-bearing region in Northern Georgia. That part of the State abounds in ancient remains, among them numerous burial-mounds of the native tribes. In these mounds, especially in those on the banks of the Etowah River, silver ornaments and gold beads have been found. They are of the native, unalloyed metal, and have been hammered into shape. But the finest gold and silver specimens from the South were those exhibited by Mr. Kunz of New York at the American Association for the Advancement of Science at Buffalo in 1886. They included arrow or spear heads and chisels of large size and almost pure gold. These were exhumed in Florida, and were believed by experts to be of Georgian origin. That at some remote time the auriferous gravels of the Ocmulgee and Nacoochee valleys were sifted for gold, is proved by the discovery some years ago of ancient huts, earthen pots for washing the sand, etc.

These antique miners were traders as well, and sent their scraps of bright metal not only to Southern Florida, but into the areas of Ohio and Indiana. That mysterious people, "the mound-builders," had acquired various trinkets in both the precious metals; and by their lucky superstition, that the dead would be pleased to wear them in the happy hunting-grounds, many have been perfectly preserved in the old graves to this day.

They have all the appearance of a Georgian origin, so far as the gold is concerned; but the silver generally looks as if it came from the North-west; it is usually carefully hammered out into a thin leaf, and is laid over ornaments of bone or stone. Evidently it was highly prized, and employed with the greatest economy to obtain as much display as possible. Strange it is to find these two metals so eagerly pursued and so highly esteemed by man everywhere, no matter what his stage of culture. But they were too scarce in the territory of the United States to tempt the cupidity of the Spaniard, blinded with the glittering palaces of Montezuma and the Incas. On one of the old Spanish maps the whole of the Mississippi valley is marked in large letters, "land of no account" (*tierra de ningun provecho*), because it yielded no gold; and one of their authors explains this profoundly by stating that it is poor in gold because it lies too far from the Tropic of Cancer! They had a theory that the heat of the sun develops gold in the veins of the rocks.

The metal best known to the Indians was copper. This they used so largely that a European antiquary has affirmed that they should be distinguished as living in a "copper age" of culture. This would not be correct, however, as at no time did they employ this metal to any great extent to produce a cutting edge. To the last, their tools continued to be made of stone or bone.

The earliest voyagers to the New-England coast and to Virginia mention that the braves wore copper ornaments, shaped like fishes or animals, and had pipes of the same metal. We know, from abundant specimens, that they also occasionally hammered it into arrow-heads and chisels. It was the native, impure copper, and could not have been nearly so serviceable as a knife or lance-point of quartz, for the edges of these ancient copper weapons are easily turned by substances no harder than serpentine or gypsum.

Probably the supply of copper on the eastern coast of the United States came principally from the mines in the mountains of New Jersey. At that point there were deposits of a nearly pure native copper; and that they were known and worked by the Indians, we are informed by the Swedish naturalist Peter Kalm, who describes the locality as he saw it, about 1740.

Quantities of copper implements have been collected in the Ohio and upper Mississippi valleys. One gentleman alone has in his private museum over three thousand specimens. They include celts, chisels, arrow-heads, lance-points, knives, beads, rings, gorgets, amulets, etc. Many of them are carefully and tastefully manufactured, and prove that their makers had clear ideas of symmetry and beauty. Some of the most attractive specimens are from the mounds of Southern Ohio; and plainly, those "mound-builders," whoever they were, had as eager a hunger for copper as, according to the Virgilian sentence, "*Auris acra fames*," the Romans had for gold.

Modern metallurgists trace pretty much all the copper found west of the Alleghanies to the great natural deposits of the native metal on the shores of Lake Superior. By analysis, it is shown to be the same. But the Indians who inhabited that locality when the whites arrived, knew nothing of utilizing the abundant fragments of native copper to be had for the seeking. When, however, the metallic deposits there began to be exploited, extraordinary evidences of previous labors came to light. Some anterior, ancient race of miners had prospected the country thoroughly, and scarcely a valuable surface vein had escaped their notice. Miles and miles of trenches had been dug, and thousands of tons of earth removed, so as to expose the cupriferous deposits. Sometimes these primitive excavators had descended as far as twenty-five or thirty feet, and their basin-shaped diggings were frequently a hundred or a hundred and fifty feet in diameter.

Their methods were evident from the numerous tools and refuse they had left. They broke the matrix with stone mauls or sledges; and, if it was very hard, they first built fires upon or against it, to crack the rock. They must have had brawny arms, as these mauls are heavy, some weighing thirty, one thirty-six, pounds. The rock being broken and hammered away from the imbedded copper, the latter was laid aside, and the refuse shovelled away with cedar shovels; water that flowed into the mine was baled out with bowls of cedar-wood; wedges and adzes of stone were employed to enlarge cracks in the rock; and the signs of skilled workmanship are visible in all their arrangements.

Neither in copper, however, nor in any other metal, were the ancient Indians acquainted with the arts of smelting or soldering. Every piece was hammered cold into the shape desired. Any specimen showing welding, casting, or rolling may be looked upon with the greatest suspicion. It may be of Indian origin, but it is of late manufacture, after intercourse with the whites had taught the natives new arts.

In conclusion, we may add, that iron, except meteoric iron, was wholly unknown before the Europeans introduced it. Small fragments of native meteoric iron, hammered into thin plates or scales, have been disinterred from the Ohio mounds.

Media, Penn., *Nov.* 1, 1887.

[Original in *Popular Science News.*]

ON THE FORMATION OF RIVER TERRACES.

BY W. R. LIGHTON.

The literature of this distinctive feature of post-glacial geology is abundant, and the theories therein advanced are only less ingenious than numerous: yet a prolonged and careful study of this literature, undertaken in close connection with quite extended field-work and direct study of the terraces themselves, and the general laws to which they are conceded to owe their being, has awakened in my mind a doubt as to the ability of the generally accepted theories to account for many somewhat minor, and even some of the more important of the observed phenomena; and so I wish to call attention, in this paper, to what I conceive to be the true history of their formation. Some of the features of this theory are not of my own conception, some are; and I believe that the theory as here presented in entirety has not been advanced before.

It is hardly necessary to speak of the general features of structure and appearance of the terraces, yet a few words of description may not be out of place.

In almost all of the rivers which lie within the area covered by the glacial drift, there are to be observed, at various heights above the present bed of the stream, one or several more or less sharply defined bluffs or terraces, resembling in general character the bluffs which define the present bed, and recognized as having constituted successively the bed and banks of the river as it rose or fell from one level to the next; the physical constitution of the terraces making it evident that they have been constructed of drift material, in large part at least.

Usually the terrace at the greatest elevation (when there are several) is composed of coarser material than that forming the lower ones.

The idea usually advauced and insisted upon is, that at the close of the glacial epoch the entire surface of the drift-covered area sank, the depression being greatest at the north, thus permitting the valleys to fill with an accumulation of drift-derived sediment, and that following this came the terrace epoch, during which the surface was again elevated by successive steps, corresponding to the several terraces, by which elevation the velocity of the stream was increased with a corresponding increase in its power to transport the detritus of its valley, — this power, mathematically stated, varying as the sixth power of the velocity, — and thus at each of these uplifts the stream would be enabled to transport an increased amount of detritus, and would cut down through the bed. That this last-named result would follow is indisputable, and yet there are several objections to the theory.

Rivers closely contiguous in area, or tributary one to another, show a very great difference in the number and position of their terraces; one stream showing but one or two, strongly marked, while an immediately adjoining or tributary stream will exhibit a considerable number of smaller ones, with a much less difference in height between them: and yet, because of their close proximity, we can hardly suppose so great a variation in the rate of elevation of the different valleys. If we adopt this proposition, this variation is only to be accounted for by supposing a stoppage or obstruction of the current in one or the other of the streams, and this it is difficult to conceive if we suppose a constant increase in the elevation of the surrounding country, and in consequence a constaut increase in the velocity of the stream.

At any rate, this variation would hardly be universal in its occurreuce under these circumstances.

Again: if these terraces were formed while the surrounding country was undergoing a constant fluctuation of level, instead of finding the terraces, as we do, composed of materials regularly graded from coarse gravel or pebbles in the upper, through finer gravel, sand, and clay as we pass to the next lower and lower, we would expect to find, at least in occasional instances, a considerable unevenness of arrangement resultant upon the fluctuation of velocity.

That change of level occurred in some cases is proven by finding remains of marine animals or plants buried in the terraces which are close to the sea-coast, at considerable heights above the present sea-level. But this evidence has no application to the interior valleys, and no other reliable evidence of actual post-glacial subsidence and elevation is to be observed in the general interior of this country; and, from the little knowledge we have of coast-elevation in general, it is not altogether irrational to suppose that this post-glacial elevation may have been confined to coast-regions.

Now, it is easily to be conceived, I think, that all of the observed features of the terraces of our interior rivers may be accounted for without the hypothesis of subsidence and succeeding elevation, as I shall attempt to explain, referring in my explanation to the accompanying sketch, which is an ideal section of a terraced river-valley.

For simplicity and convenience I have conventionalized this sketch, or represented opposite banks of the stream as similar in character, with the terraces equal in number, and of the same height on the two banks. This rarely occurs in

nature. Sometimes only one side of the valley will exhibit terraces at all, and sometimes they occur on opposite banks alternately, at varying heights. This is in large measure to be accounted for by the constant shifting of the current from one side of its bed to the other, and to the sinuousness of its course, which is constantly changing. Some effect is also to be attributed to the erosion of the terraces after their formation.

In the sketch, let the strong line 1 — 1 represent a depression in the general ground surface at the close of the glacial epoch, through which the stream began its flow; 2 — 2 are two terraces at equal heights on opposite sides of the stream; 3 — 3, two opposite terraces formed at a later period; and 4, the present position of the river. As above suggested, let the line 1 — 1 indicate the land surface at the time when the great ice-sheet reached its culminating point, and began to recede.

The waters which resulted from the melting of the glacier, flowing from beneath the sheet as well as from its lower margin, would fill the valley with a great torrent, which would be so exceedingly overburdened with detritus, that a deposit of the detritus would take place, particularly in the upper portions of the valley, very much after the manner of deposit of the glacier itself; and this material would accumulate to great depth, with but slight stratification or lamination, until the great excess of supply began to decrease, and the natural law of transportation and deposit to assert itself: and thus, although the deep deposit below would contain a great admixture of coarse material, the upper surface would be covered with material more generally coarse than that underlying, because this would be the first deposited from suspension in the stream as it began to right itself.

The valley would now be filled with sediment to the height of the terraces 2 — 2; these, with the curved dotted line connecting them, representing the bed of the stream at this time.

Now, as the supply of water decreased, the stream would not occupy the full width of its bed, but would be gradually confined to a narrower and narrower area; and as it becomes less and less in volume, its deposit would in great measure cease, and it would then begin to cut down through its bed, this effect being accelerated by every freshet, however slight, by which the volume and velocity of the current would be increased. This erosion being confined to that portion of the old bed which was covered by the water, the formation of the terraces would begin, progressing until they would constitute the flood-plain of the river, or that portion only covered in time of freshet; and finally they would not be covered, even in time of flood, the stream being confined to its newly made bed, which would be at the level of the second set of terraces, 3 — 3: and, the diminution of the stream continuing, in time the second set of terraces would be formed, the decreased velocity of the stream causing them to be generally finer in texture than those above, as the stream could not now transport material which it could easily carry while the upper terraces were forming. Finally, we would find the greatly shrunken stream confined to its present bed, 4, where the gradual elevation of the flood-plain, and erosion of its bed, are now going on.

This effect, condensed and abbreviated as to time and extent, I have traced many times in the small brooks and streams of the Missouri and Mississippi valleys, particularly where their course is through a loose sandy or clayey soil.

During long, steady rains, where the water-supply is constant, and not paroxysmal, deposition of sediment will take place in the bed; in small streams, when the rain lasts for a sufficiently long time, entirely filling the old stream-bed, and then, when the water-supply begins to decrease, erosion will occur, and low, broad terraces will be formed, — simple miniatures of their elder brethren. When the stream is wide enough to permit of it, these terraces are sometimes formed in succession, and at two or three heights; this result occurring without any sudden variation or sudden increase or decline in volume or force of the stream, thus affording a beautiful confirmation of the theory advanced above

LEAVENWORTH, KAN., *Oct.* 1.

SCIENTIFIC BREVITIES.

NATURAL FREE IODINE. — Iodine, hitherto known in nature only in combination with other elements, is now found in a free state in the water of Woodhall Spa, near Lincoln, Eng. The water is colored a decided brown by the iodine.

COLORED PAPER. — Several of the French railway companies and other public bodies have resolved on having their printing done on green instead of white paper. The reason for the alteration is, that they believe the combination of white paper with black characters endangers the eyesight of their workpeople. Black on green has always been recognized as a good combination, and many railway tickets are so printed.

A LARGE NUGGET. — On the 30th of August last an immense nugget, weighing about 51 pounds of pure gold, was unearthed in the Midas Mine at Sulky Gully, near Ballarat, Australia. The nugget is flat, and has something the shape of a colossal hand held open, with the thumb and fingers close together. Its greatest length is 12½ inches, and breadth 8½ inches, and it varies in thickness up to 2½ inches.

SALICYLIC ACID AND DRY ROT. — A Bohemian chemist has found that salicylic acid is a preventive and a cure for dry rot. At first the acid was used in the dry or powder form, but latterly the greatest success has been achieved, according to Professor Farksky, by dissolving five ounces and a quarter of salicylic acid in one quart of common spirit, and diluting this solution to a convenient degree with water at the moment of using it. In some of the old houses of Bohemia dry rot is a very dangerous thing, especially when it attacks the principal beams, which are mostly of beechwood.

CHANGES IN THE OHM. — Hlimstedt has repeatedly remeasured certain standards constructed of German silver, and has discovered that, independent apparently of changes of temperature, the resistance of German silver undergoes a slight change. He calls attention to the custom of Messrs. Siemens & Halske of keeping their German-silver wire six months, after it is covered and wound, before it is used for electrical standards of resistance.

SOLIDIFICATION OF LIQUIDS BY PRESSURE. — Theoretically, the formula given by J. Thomson implies that solidification becomes possible at a given temperature and under sufficient pressure, provided the density be greater in the solid than in the fluid state. Practically, no instance is known of any liquid — properly so called — being capable of solidification by pressure alone. At a recent meeting of the Paris Academy of Sciences, however, Mr. E H. Amagat stated, that, after a number of experiments, he has succeeded in solidifying the bichloride of carbon (C_2Cl_4), obtaining some crystals which appear evidently to belong to the cubic system. This substance is solidified at the temperatures of —19.5°, 0°, 10°, and 19 5° C., under the respective pressures of 210, 620, 900, and 1,160 atmospheres. This and other results would seem to imply that every fluid has a critical point of solidification; that is, a temperature above which solidification will take place under no pressure: just as there appears to be a temperature below which the body remains solid under the slightest pressures.

THE SOUTHERN-CROSS PEARL. — No explanation ever has been, or ever will be, forthcoming of the extraordinary freak of nature in the formation of this famous pearl. Originally discovered at Roeburn, in Western Australia, it consists of nine pearls adhering together in the form of a Latin cross, — seven in the shaft and two in the arms; one on each side of the shaft, nearly opposite the second pearl from the top. The pearls are slightly compressed, like peas in a pod; and no trace of any artificial junction can be observed. It has been suggested that a fragment of sea-weed may have gotten into the shell, and formed the frame of the construction. The pearls are of fine quality, though slightly misshapen at parts, and the value of the gem is very high. Its character is unique, and so filled the owner with superstitious awe, that for a long time he was induced to hide it away, and keep his possession of it a secret.

PRESSURE AND VOLUME OF STEAM. — Steam, as compared with water, occupies 1,728 times as much space. A cubic inch of water will make 1,728 cubic inches of steam at atmospheric pressure. Now, if this steam is compressed into half the space it occupies at atmospheric pressure, it will be double that pressure, or 15 pounds above the atmosphere; it will then occupy only 864 cubic inches. If reduced again to half its volume, it will occupy 432 cubic inches, and will have 30 pounds pressure. Reduced again to half the volume, the steam will occupy 216 cubic inches, and will have 60 pounds pressure to the square inch We can go on reducing in this way, until we find that a cubic inch of water turned into steam, and compressed into a space of 3 cubic inches, will have the enormous pressure of 3,840 pounds to the square inch.

Practical Chemistry and the Arts.

THE ANILINE COLORS.

Every one has seen and worn fabrics dyed with the brilliant aniline colors, but few are acquainted with the process of their manufacture, or understand how, from so unpromising a liquid as coal-tar, a substance offensive to almost every sense, such a variety of beautiful dye-stuffs can be made at a cost far below those formerly used.

When bituminous coal is heated in retorts, as in gas-making, among other substances a black, dirty, ill-smelling liquid is produced, known as coal-tar. From this, numerous chemical compounds can be obtained; but the principal ones concerned in the manufacture of aniline are two liquid hydrocarbons, known as benzol (C_6H_6) and toluol (C_7H_8). These are obtained mixed together by distilling the coal-tar; but, for the sake of clearness, we will consider the benzol alone, it being understood that the toluol which is mixed with it undergoes similar reactions in all subsequent processes.

The first treatment which the benzol undergoes is a change to nitro-benzol ($C_6H_5NO_2$) by the action of a mixture of nitric and sulphuric acids. This change is analogous to that of glycerine into nitro-glycerine, but the nitro-benzol is not explosive. It is an oily liquid, with a powerful odor of almonds, and is used extensively in perfumery under the name of essence of mirbane. It is also used in flavoring extracts for food, but its highly poisonous properties render this a very dangerous practice.

By the action of reducing agents the oxygen of the nitro-benzol is replaced by hydrogen, and we obtain aniline ($C_6H_5NH_2$). Various methods are used commercially for this reduction; but the action of nascent hydrogen, formed by the action of acetic acid upon iron-filings, is one of the most practical. The filings and acid are added to the nitro-benzol, and the whole stirred together till the reaction is finished. The crude aniline oil resulting from this process, which is essentially a mixture of aniline, toluidine, and pseudo-toluidine, is a regular article of commerce, and the base from which all the various colors are made.

Aniline red, otherwise known as magenta or fuchsine, was one of the first colors discovered, and is a salt of a base known as rosaniline, usually the chloride or acetate. Rosaniline itself ($C_{20}H_{19}N_3$) is colorless, but the salts mentioned above have the well-known red color.

Rosaniline is formed from aniline oil by a process of oxidation. The oxidizing agent most commonly used is arsenic acid, although its poisonous nature renders it somewhat unsuitable for this purpose. All but a trace is removed from the finished product, but enough is frequently left to produce distinctly poisonous symptoms in persons wearing garments dyed with this substance. The following is the reaction expressed by chemical symbols: —

Aniline Oil.		Arsenic Acid.		Rosaniline.		Arsenious Acid.		Water
$2C_{20}H_{23}N_3$	+	$3As_2O_5$	=	$2C_{20}H_{19}N_3$	+	$3As_2O_3$	+	$6H_2O$.

A ton of coal gives about sixty pounds of tar, from which about 3.37 per cent of crude aniline red, or 1.12 per cent of pure fuchsine, can be obtained. Practically about one and a half tons of coal are required to make a single pound of fuchsine; but the pound of fuchsine possesses such a high coloring power, that it will dye two hundred pounds of wool.

Taking rosaniline as a basis, most of the other colors are prepared by the action upon it of various chemical reagents. The symbols of these dyes are quite complex, and of interest only from a theoretical point of view. By the action of bichromate of potash and sulphuric acid upon rosaniline we obtain aniline violet. By heating fuchsine and aniline oil together, and treating the product with hydrochloric acid, aniline blue is formed. Aniline greens are formed by the addition of sulphur or iodine. Aniline yellow is formed by the action of nitrous acid upon an alcoholic solution of rosaniline.

Aniline black is really a very deep green formed by the action of oxidizing agents upon aniline oil. It is of special interest from the method of its manufacture, a minute proportion of a salt of the rare metal vanadium being added to a solution of aniline chloride. The vanadium appears to be alternately oxidized by the air, and reduced by the aniline, thus acting as a carrier of oxygen from the air to the aniline. A very small amount of vanadium will transform a large quantity of aniline chloride into aniline black, and the process is curiously analogous to fermentation.

Like most substances containing nitrogen, the aniline colors are very unstable, and their complex molecules constantly tend to break up into simple forms. It is this tendency which causes them to fade so rapidly upon exposure, and renders them unsuitable for use where a permanent and lasting dye is required. It is a very curious fact that this group of organic chemical substances, all related to each other, should be characterized by such a variety of brilliant colors; but it is not more strange than that, in the inorganic world, the salts of the metal chromium should show this same variety of color, or that the salts of glucinium should have a sweet taste, or the compounds of selenium or sulphur an offensive smell. It would seem as if, in any molecule, certain atoms or radicals had a dominating influence over the others, and imparted their peculiar qualities to the whole group. Why this is so, is as yet an unsolved problem; but we have little doubt, that, before many years have passed, the key will be found by some of the many students of chemical philosophy who are patiently working upon this very question.

[Original in *Popular Science News.*]

THE SIGNIFICANCE OF A SANITARY ANALYSIS OF WATER.

BY HENRY CARMICHAEL, PH D.

To understand what importance, if any, is to be attached to a chemical analysis of water, it is necessary to briefly survey the history of the latter from the time it rises as vapor, under the influence of solar rays, from the bosom of the great ocean, until, descending upon the continent as rain, it returns to its source, again to be distilled in endless repetition.

The invisible vapor carried by air-currents inland, at its first precipitation as cloud, commences to absorb the solid and gaseous impurities of the atmosphere; and long before the rain-drops reach the earth, they receive appreciable quantities of ammonia, ammonium nitrite, carbonic acid, floating mineral and organic matter, as well as the germs of microscopic animal and vegetable life. To speak accurately, not a drop of water can be found in the natural world which is pure. Fortunately, the substances washed from the air are, with rare exceptions, innocuous. Some of them are indispensable to the life of the globe. Of first importance are ammonia and other nitrogen compounds. Although nitrogen forms four-fifths by bulk of the atmosphere, so inert and apathetic is it in its chemical relations that it is only with extreme difficulty that we are able to force it into combination with other elements. Nitrogen in combination is an essential constituent of proteid matter, with which life in both animals and plants is more immediately associated. Animals derive combined nitrogen from plants; plants derive it from the minute traces contained in the air. The combined nitrogen in the air, it is supposed, is generated by a mysteriously active form of oxygen called ozone. So parsimonious is nature in its supply of this indispensable plant-food, that, while millions of tons of free nitrogen cover the fields, to eke out the supply of combined nitrogen brought down by the rain, the latter form of nitrogen, under one name or another, must be bought by the thrifty agriculturist at about fifteen cents per pound. It brings us now near to our subject, as will be seen below, to observe that the combined nitrogen scantily present in rain-water is accumulated in plants, and in a still greater degree in the animals which feed upon them, and is found in the excreta of the latter, without much loss, in great abundance.

Animal waste is rich in nitrogen, and any considerable accumulation of combined nitrogen in nature is the product of animal waste.

An analysis of sewage or of water contaminated by it should reveal, therefore, an excess of combined nitrogen.

Rain-water on its way to the sea may flow over the surface of the ground, conveying, in suspension and solution, both organic and mineral matter to the nearest river, or it may slowly percolate through earth; and during its long sojourn, aided by the solvent power of carbonic acid, receive in richer proportion than in the other case mineral matter. As a general rule, river-water is soft, but abounds in organic matter. Spring-water is hard; and, if its gathering ground is at a distance from the habitations of men, it is nearly free from organic matter.

Well, spring, and river waters commonly contain carbonates, sulphates, and chlorides of such bases as calcium, magnesium, iron, potassium, and sodium.

So far we have encountered no contamination injurious to life or health in this enumeration; and, going farther, we assert that *there is no proof that human or other filth largely diluted in water-supplies is of itself in the slightest degree unwholesome.* In some instances this sewage contamination promotes the growth in still waters of minute forms of life which under the microscope appear quite alarming; but the history of most of them is as well understood as that of the cabbage, and their physiological action, when absorbed into the system, even less momentous. If any one is too fastidious to permit these interesting creatures to "play tag" in his stomach, it is only needful that

the water be boiled and filtered. After this survey, it is time to admit, that, beyond the identification of lead, arsenic, and a few other toxic substances that do not generally come within the scope of a sanitary water analysis, *chemistry alone is today incapable of declaring whether a given water-supply is or is not injurious to life.*

Of what use, then, is water analysis for sanitary purposes? We reply, much, through the indirect connection that exists between the organic matter found and the organized matter which, though unseen, produces disease.

Unfortunately, it not unfrequently happens that a large or small community is smitten with that terrible scourge, the typhoid-fever, which without difficulty is proved to have originated in the water-supply.

Chemical analysis reveals no unusual constituent; still, the water is deadly. This is not the place to recite the argument, bnt authorities agree that the only rational explanation of the phenomenon is the germ theory.

The germ is a minute plant which grows at the expense of its host, and then escapes to fasten upon other victims.

The excreta from some previous sufferer have been carelessly disposed of, and from vault or cesspool found the way, over or below ground, to the well or river which supplies the community. After the usual period of incubation, under favoring conditions it vastly multiplies, and asserts itself by a reproduction of the fever.

It might then appear that the examination of drinking-water should be relegated to the biologist, and conducted by means of a microscope rather than a test-tube ; but the mistakes made by the great apostles of microscope cultures, Koch and Pasteur, prove that such a method is as yet too delicate to be practicable.

The object of a chemical analysis is to point out the danger, not which exists, but which possibly exists, whenever drains or cesspools communicate directly or indirectly with well or stream. Drinking-water should be beyond reproach; and as the germs of zymotic or filth diseases naturally would travel by the same routes as the waste water of dwellings it is sufficient usually to prove the safety of any given water by proving chemically the absence of those materials which are not, indeed, peculiar to sewage, but which exist there in the greatest abundance. The chemist determines for this purpose the amount of free ammonia which exists in rain-water, as we have seen, but only to the extent of about 0.24 parts in one million, and which in much larger quantities indicates the recent addition of putrid animal matter. Again : there is determined the organic nitrogen or "albuminoid" ammonia, which should not exceed, under ordinary circumstances, 0.2 parts, and in large amounts proves direct pollution.

As the sewage is eventually exposed to oxidation, it may lose all of the ammonia and albuminoid ammonia; but the results of analysis still disclose them as nitrates or nitrites. These may in turn be destroyed ; but there will still remain, as an indestructible indicator of previous contamination, an inordinate quantity of chlorine from the salt consumed by man. In most cases the soil contributes only traces of chlorine. In some instances the total solid matter and the total organic matter suggest important conclusions.

It does not appear that a water-supply is freed wholly from malignant germs by filtration or aeration ; and so long as evidence of animal contamination continues, it remains under suspicion.

Having made all possible tests in the laboratory, the chemist's opinion as to the relative safety of different samples presented may be as wide of the truth as a clairvoyant's, unless he is permitted personally to inspect their sources or otherwise to know their history.

A proper interpretation is still a difficult matter, and a greater certainty by the microscopic identification of germs in ordinary water examinations is greatly to be desired.

7 Broad St., Boston, *Nov.* 15, 1887.

THE SOLUBILITY OF ISOMERIC ORGANIC COMPOUNDS.

1. *For any series of isomeric organic compounds, the order of solubility is the same as the order of fusibility ;* i.e , the most fusible compound is also the most soluble.

This is shown to hold true in a very large number of cases, whilst there are very few exceptions, and those of a doubtful character.

2. *The order of solubility of two or more isomeric compounds is independent of the nature of the solvent.* This has been experimentally proved, more particularly in the case of meta- and para-nitraniline, the solubility of each of which in thirteen different solvents has been determined; also by a considerable number of cases taken from literature.

3. *The ratio of the solubilities of two isomers in a given solvent is constant, and is therefore independent of the nature of the solvent.* So that —

$$\frac{\text{Solubility of A in any solvent}}{\text{Solubility of B in the same solvent}} = \text{constant.}$$

This has been proved for meta- and para-nitraniline in respect of thirteen different and very varied solvents. — *Professors* Carnelley *and* Thomson *in Chemical News.*

RAILROAD NOTES.

A Curious Accident. — A singular railroad accident recently occurred in England caused by an oil-cask in a wagon of a freight train which leaked upon the rails for a considerable distance, and so lubricated them that a mineral train overran the signal, and dashed into a shunting goods train. A passenger train followed, and not being able to pull up in time, owing to the slippery state of the rails, ran into the mineral train, causing injuries to two railway servants and twelve passengers.

Railroad-Building in 1887. — There were added to the railroad system of this country during the year 1886 about 9,000 miles of new mileage, — an amount never before exceeded, except in 1881, when the new mileage was 9,358, and in 1882, when it was 11,591 miles. During the present year there have been laid, to Sept. 1, about 7,000 miles, which make it very probable that the new mileage of 1887 will exceed that of 1886.

Locomotive Tests. — During some recent tests the Lehigh Valley locomotive "H. S. Goodwin" drew 132 loaded coal-cars from Pattenburg to Perth Amboy, and returned to Easton with 125 empty cars. Considering that the driving-wheels of the engine are 5 feet 6 inches high, this is a good pull. The number of revolutions of the wheels was ascertained to be 289 per mile. The cylinders on the engine are 19½ inches. The recent tests showed that the engine worked better and freer with twelve or thirteen passenger cars than with five or six. Professor Kline, who has charge of the tests, now proposes to give the engine higher valves and 18-inch cylinders Other changes are to be made so as to increase the speed of the engine to 80 miles per hour. This, it is claimed, can be done without much difficulty. At that rate of speed the "Goodwin" will be expected to haul five and probably six, cars.

A Tricycle fire apparatus is a novelty in London, Eng. It is propelled by two riders, and carries a pumping engine and a coil of hose, and the total weight is three hundred pounds.

INDUSTRIAL MEMORANDA.

The Monkey-Wrench takes its name from Charles Moncky, the inventor of this screw-bar wrench, who received only two thousand dollars for his patent, and is now living at Brooklyn in a small cottage bought from the proceeds of this sale.

A New Application of Electricity. — M. Garel has invented an electrical method of preparing paper stencils for letter, circulars, etc. In this apparatus a piece of very thin paper rests on a carbon block connected with one pole of a small induction coil, whilst the style, with which the writing is done, is connected with the other pole. On using the apparatus a series of sparks pass between the style and the carbon block, perforating the paper, which can then be used as a stencil in the ordinary way.

Capacity of Pumps. — To find (approximately) the amount of water a pump will move per minute, assuming a hundred feet piston speed as the standard, square the diameter of the water cylinders, and divide by four; and inversely, to find the size of a pump to perform a required duty in gallons, divide the number of gallons by four, and extract the square root of the quotient. The result is the diameter of water cylinder required.

Water-Power from Artesian Wells. — Many artesian wells spout water under a heavy pressure, just as many gas-wells find the gas under a pressure of several hundred pounds to the square inch. This water-power is used in many places in France by means of turbine wheels, and it is probable that even the gas pressure might in some cases also be utilized. In very deep artesian wells the heat of the water is also utilized.

Value of Seaweed. — "Worthless as a weed" does not evidently apply to seaweeds. A hundred tons of air-dried seaweed will yield, besides its salts, seventy tons of algin and fifteen tons of cellulose. The algin is a glutinous substance, with fourteen times the viscosity of starch and thirty-seven times that of gum-arabic. It is used for sizing, as a mordant in dyeing, in cookery, the making of confectionery, the manufacture of paper, to prevent the incrustation in steam-boilers, and many other uses.

Use of the Magnet in Paper Manufacture. — During the manufacture of paper, as soon as the pulping machines exhibit signs of wear, it is not uncommon for a good deal of paper to be spoilt by the abrasion of minute specks of iron which fall into the pulp and afterwards produce rust-stains. Occasionally the stains do not appear until the paper has been damped for printing, and a good deal of annoyance is thus caused. The *Papier Zeitung* announces that this difficulty may be overcome by the use of magnets in a very simple and effectual manner A kind of steel comb, with broad teeth set edgewise, is placed in the stream of pulp and water which issues from the machine. The teeth are made of magnetized steel strips, and any iron particles contained in the pulp are thus withdrawn.

A Remarkable Water-Power exists on the coast of Cephalonia. Along near the shore are a large number of fissures or pits, in which is fresh or salt water as the case may be. The water in these pits rises and falls, the same as it does in the sea outside; but what is remarkable about it is, that the level of the water in the pits is four feet lower than in the sea. What is more remarkable is, that allowing water to flow into these pits does not fill them up, and shutting it out does not cause them to empty. This difference of level has been utilized for a water-power by placing a water-wheel in one of the pits, and allowing the water from the sea to flow to the wheel through a suitable channel.

Home, Farm, and Garden.

THE CHEMISTRY OF ARTIFICIAL LIGHT.

The methods by which our homes are illuminated and made bright and cheerful during the long winter evenings, can be divided into two classes, — those in which the illuminating materials are consumed on the spot, as in all kinds of lamps and candles, and those in which they are manufactured on a large scale at a central station, and distributed to the places where they are required, as in the case of gas or electricity.

Beginning with the simplest illuminant, the candle, let us trace the various chemical changes produced in its burning. All the various substances used for candles — tallow, paraffine, spermaceti, wax, etc. — are known by the general chemical name of hydrocarbons, and are composed of hydrogen, carbon, and oxygen in varying proportions. The oxygen takes no part in producing light, and the only elements to be considered are the two first-named.

The first action which we observe in a burning candle is the liquefaction of the solid substance by the heat of the flame itself. If we examine the top of a burning candle, we shall observe a little cup-shaped depression full of the melted wax or tallow, which is constantly being absorbed by the wick, and renewed by the melting of fresh material as the candle burns down. Thus we see that our candle is really a small lamp, in which the oil is formed as it is needed.

Few of the light-producing solids or liquids in common use can be ignited by themselves; but, when finely subdivided by the little capillary tubes formed by the interstices of the wick, the heat of the flame is sufficient to cause combustion to take place, which continues as long as there is a supply of material.

As the oil or melted wax reaches the flame, some very complicated chemical reactions take place. The liquid hydrocarbons are decomposed by the heat into gaseous hydrocarbons, of various proportions of carbon and hydrogen; these in turn unite with the oxygen of the air, the carbon forming carbonic-acid gas, and the hydrogen water-vapor or steam. By holding a cold plate over a lamp or candle flame, this vapor is condensed into water upon the cold surface, and its presence made evident. It is this condensed aqueous vapor which causes a lamp-chimney to become dim when the lamp is first lighted.

If we lower the plate into the midst of the flame, the deposit of lampblack proves the presence of the gaseous hydrocarbons, and probably of particles of carbon itself.

By carefully observing a candle-flame, we shall notice that it is composed of three layers, or zones. The inner one surrounds the wick, and is of a bluish color. It is composed of the unburned gas before it has come in contact with the air. The second, or luminous zone, is composed of the gases or carbon particles which are incompletely burned, but are at such a high temperature that they have become incandescent, and shine like a piece of white-hot iron. It is an unsettled point whether this incandescence is due to solid particles of carbon or to heavy hydrocarbon gases, but the cause of the luminosity is the same in either case. The third, or outermost zone, is not very conspicuous, and is that in which the combustion is completed, and the carbon and hydrogen finally oxidized to carbonic dioxide and water. We thus see that our candle is not only a small lamp, but a miniature gas-works as well, and that in a candle or lamp we are burning gas just as truly as if it issued from a gas-burner. We also see that the light-giving power of the candle is due to incomplete combustion; for if we introduce a stream of air into the interior of the flame by means of a blowpipe, it at once loses its light, and becomes of a pale-blue color, hardly visible in daylight. The Bunsen gas-burner, universally used in chemical laboratories, is arranged to burn a mixture of gas and air, and gives a non-luminous but very hot flame.

The chemical phenomena of a gas-flame are identical with those of a lamp or candle. Instead of being formed at the wick, the gas is distilled from bituminous coal containing a large amount of hydrogen; and the hydrocarbon gases thus formed are conveyed by pipes to the spot where they are to be consumed. No wick is required in this case, as the gas sustains its own combustion.

Lighting by electricity is a purely physical process, and no chemical changes are involved in it. The power which moves the dynamo-machine, and produces the electricity, is developed by a steam-engine and boiler; and as the light-giving power of candle, lamp, or gas-jet depends upon the incandescence of heated carbon, so we may trace back the light given by the electric current to the carbon of the wood or coal burning under the boiler, and show that even this beautiful light is dependent indirectly upon the oxidation of that important element: or we may go even farther, and claim that the white-hot filament of carbon in the exhausted bulb represents the incandescent particles of carbon or hydrocarbon gases in the lamp-flame, and can truly say that the electric light is a flame in which no combustion takes place.

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THE MYSTERIES OF PLANT-GROWTH.

BY FRANCIS WYATT, PH.D.

X.

[*Conclusion.*]

The term "amendment" has been given to substances which, when they are applied to a soil, effect a change in its general constitution; and thus lime, when mixed into strong, stiff, and unworkable clays in the proportion of from ten to fifteen tons to the acre, induces in them a far-reaching chemical decomposition, which, in addition to partially transforming them into the more porous silicates and aluminates of lime, sets free large quantities of alkaline salts that were previously unable to co-operate in the phenomena of vegetation because bound up in insoluble combinations.

This marvellous effect would of itself give to lime an incalculable value, and create for it a very high place in the estimation of farmers; but it by no means represents the total scope of its usefulness, as I hope to make clear to those who follow me by recalling its properties as a generator and promoter of combustion. The immense accumulation of vegetable remains, in various stages of decay and putrefaction, found in most virgin lands, and in all meadows, marshes, and swamps, and known by the name of humus, so entirely acidify the soil that its normal basic or alkaline reaction, is destroyed. It can consequently no longer afford nourishment to any of those plants which generate the elements of animal food. In order to bring such lands under successful cultivation, it is therefore necessary to at once neutralize their acidity, render them alkaline, and remove the excess of organic matters by which they are encumbered.

All these conditions are perfectly fulfilled by burnt lime. The word "combustion" designates that process by which an organic body principally composed of carbon and hydrogen, with traces of nitrogen, unites with the oxygen of the air to form oxides Thus, coal, coke, wood, and vegetable refuse, although burnt to create heat, and apparently thereby destroyed, in reality merely undergo a chemical change arising out of that scheme of nature which has provided for the restoration of all their constituents to the atmosphere and the soil.

The carbon, hydrogen, and nitrogen combine with the oxygen of the air to form carbonic-acid gas and ammonia, while the ash consists of oxidized mineral matters.

Every element, save fluorine, combines with oxygen to form oxides, and spontaneously develops more or less heat in the process of oxidation. The warmth of the animal body is created and sustained by the oxidation of the starchy or fatty or carbonaceous elements of food; and hence, while animals breathe in oxygen, they breathe out carbonic-acid gas and steam. When this natural chemical process is stopped, the animal dies; or, to speak more forcibly, when no more food is provided, or no more oxygen inhaled, the fire ceases to burn, and every thing grows cold.

This brief definition of combustion, and establishment of oxygen as its indispensable promoter, suffices to explain, that, if such great masses of decaying humiferous matters sometimes linger in soils, it is because the latter are cold and wet, and have become so choked up and cohesive by the accumulation as to preclude all circulation of air. Hence they are beyond the reach of oxygen; and it is only when they have been warmed, dried, and made porous, that they can be brought under its influence.

To the accomplishment of all these objects, burnt lime, when properly administered, in fine powder and with an unsparing hand, is perfectly and invariably equal.

By its great affinity for water and the intense heat of its combination, all moisture is absorbed, the rapidly drying soil cracks and opens up in every direction; free ingress is thus afforded to the air, and a vigorous and permanent combustion sets in.

Attacked in its turn by the carbonic-acid gas resulting from the process, it is converted into carbonate; and, alkalinity being thus gradually restored, the plough completes the conquest, and barren wildernesses become fertile plains.

Reviewing these effects, and briefly summing up its advantages before proceeding to point out its danger or defects, we have seen, that, independently of its power to impart porosity and to facilitate combustion, lime sets free various alkaline salts from useless combinations, and renders them available as plant-food. It also decomposes certain

injurious salts of iron, magnesium, and manganese, counteracts the evil influences of all kinds of sulphurous emanations, and, before being transformed into carbonate, destroys, by its causticity, vast quantities of ravaging insects and their eggs.

Although it may be easily conceived, and as readily conceded, that "desperate diseases require strong remedies," it does not follow that any modern physician would be so unwise as to act upon this rule in prescribing for the petty ailments of our every-day lives; nor, by the same reasoning, would the indiscriminate use of such a powerful oxidizing agent as free lime as a dressing to good, ordinary cultivated soils be productive of any thing but disaster. As this statement, apparently so conflicting, necessitates my defining a good fertile soil, I may at once explain that I apply that name, not to any simple compound of clay, sand, and chalk, or pure mass of either, but to a mixture containing all the elements required for plant-food, in a proper physical condition, and with a due proportion of humus or organic matter; the latter factor being undoubtedly the most important for the following three paramount reasons: —

First, Because, by its very slow combustion, it helps to maintain the warmth of the soil.

Second, Because it contains a considerable quantity of nitrogen, which is gradually transformed, by the slow combustion or oxidation, into nitric acid or nitrates.

Third, Because it has the invaluable property of always retaining moisture, and thus can enable plants to withstand periods of drought which would otherwise kill them.

However rich they may otherwise be, therefore, it has been amply demonstrated, by experiment, that no soils are perfect which contain less than two per cent of humiferous matter.

And I urge upon thinking agriculturists to untiringly contribute towards the steady maintenance of this minimum, not only by using the largest possible quantity of farmyard manure, but by carefully ploughing under, instead of burning, all the refuse from their crops. Nor does the imperative necessity of this duty become any the less potent when we reflect that the most complicated problem we have yet to solve is, whence to obtain sufficient cheap and assimilable nitrogen to integrally replace what is taken from the soil by the crops, and exported with them to foreign countries every year. The pet theory — so beautiful as a theory — of obtaining it directly from the air, in a suitable form, and at a fabulously cheap price, continues to occupy many clever brains in many scientific laboratories, but is still as far as ever from a practical solution; while from a commercial stand-point chemistry has only hitherto been able to furnish such expensive materials as sulphate of ammonia and nitrates of soda and potash. Now, as we are perfectly aware that nitrification chiefly results from the extremely slow oxidation of organic matter in alkaline soils, it quite naturally follows, that, so long as we can command a sufficiency of humus under favorable conditions, we may remain independent of outside sources, and no dearth of available nitrogenous plant-food need be apprehended.

As the magnitude of our exportations, and our misconceived notions of sanitation, prohibit, however, all hope of continuing to restore the whole of the required nitrogen in an organic form, it behooves us to manipulate what we have in a spirit of economy; to handle our soils with delicacy, care, and intelligence; and, above all things, to avoid introducing into them any substance which may interfere with their normal, regular, and natural functions. In these circumstances the enemy of all enemies the most redoubtable to cultivated, fertile soils is quick-lime; for, howsoever it may be employed, it must inevitably strike at the fundamental basis of their constitutions, and involve destruction. Under the stimulating effects of heat generated by its presence, the carbonaceous elements would undergo such rapid oxidation that the hydrogen and nitrogen would be simultaneously set free, and, uniting to form ammonia, pass off as gas into the air; and hence, although one or two exuberant crops might be produced, not only would a large quantity of the most precious element in fertility be entirely lost, but, the combustible matters being prematurely burnt up, the soil would unavoidably become cold, dry, and sterile. This energetic action and its evil consequences must have been quite familiar to our forefathers, for I have often met with old people in rural districts who, when it was mentioned as a fertilizer, would shake their heads, and say, "Lime is a dangerous friend; for, though it enrich the father, it ever impoverishes the son."

[Original in *Popular Science News.*]

A NEW HONEY-PLANT.

At the meeting of the American Association for the Advancement of Science, held last August in New York, Mr. and Mrs. Pease of Buffalo exhibited specimens of a new honey-plant, and gave details regarding its history, value, and culture. Six years ago it was sown, with other seeds from Florida, by Mr. Chapman of Versailles. The plant blossomed in the second year, and was classified by Beale and Scrinton as the *Echinops sphærocephala*. It belongs to the teazle family, and, a native of Central France, has in some unaccountable manner become naturalized in Florida. It grows from four to five feet high, and bears large prickly leaves like those of a thistle, and from twenty to thirty heads of small white flowers, which open from the top downwards. The flowers are very productive of nectar, and are therefore very attractive to bees; 2,135 bees, by actual count, visited one head of a plant between five A.M and seven P.M. Thirty heads furnish supplies for sixty-four thousand bees. The plant blossoms about the end of July, and the honey-bearing time of thirty days may be prolonged by cutting off the heads before they seed. It is a hardy plant, and easy to propagate. It will grow in any soil, even in waste places; but it does best when planted in drills on a hillside. It has been grown successfully in Canada and the United States for the last two years, and Mr. Chapman has this year had ten acres of it in full bloom. The honey is pronounced of superior quality. The plant, though a perennial, does not spread from the roots; and, as the seed has no down, it simply falls to the ground. In size and appearance the seed resembles rye. It yields an oil pleasant to smell and taste. Twenty-seven thousand seeds go to a pound, and from a pound of seed four and a half ounces of oil may be pressed. It equals linseed in yield, is heavy, and after twelve months' exposure develops no acid, and requires no burning before use. It equals any seed oil in value for burning, lubricating, and salad. From the refuse a cake is made which has a bitter taste, somewhat resembling quinine.

C.

HOUSEHOLD HINTS.

Stove-Polish mixed with vinegar and a bit of sugar will shine easier.

Mildewed cloth should be soaked in buttermilk, afterwards spreading on the grass in the sun.

Stockings. — It is said, that, if No. 24 black thread is knitted in with the yarn in the parts of stockings which receive the most wear, — the knees, heels, and toes, — they will wear very much better by so doing.

Potatoes should be placed in barrels or bins with perforated bottoms, raised a few inches above the floor to allow a free circulation of air up among the potatoes. They should be both clean and dry when stored.

To whiten Linen. — When linen has turned yellow, cut up a pound of fine white soap into a gallon of milk, and hang it over a fire in a wash-kettle. When the soap has completely melted, put in the linen and boil it half an hour; then take it out. Have ready a lather of soap and water; wash the linen in it, and then rinse it through two cold waters, with a very little blue in the last.

Selecting Meat. — Dr. Lethcby lays down the following simple rules for the guidance of those in search of good meat: 1. It is neither of a pale pink nor of a deep purple tint. 2. It has a marbled appearance, from the ramification of little veins of fat among the muscles. 3. It should be firm and elastic to the touch. Bad meat is wet, sodden, and flabby, with the fat looking like jelly or wet parchment. 4. It should have little or no odor, and the odor should not be disagreeable. Diseased meat has a sickly, cadaverous smell, and sometimes a smell of physic. This is discoverable if the meat is chopped and drenched with warm water. 5. It should not shrink or waste much in cooking.

A Cheap Floor-Paint. — Some months ago the floors of many Austrian garrisons were painted with tar, and the results have proved so uniformly advantageous that the method is becoming greatly extended in its application. The collection of dust in cracks is thus prevented, and a consequent diminution in irritative diseases of the eye has been noted. Cleaning of the rooms has been greatly facilitated, and parasites are almost completely excluded. The coating of tar is inexpensive, requires renewal but once a year, and presents but one disadvantage, namely, its sombre color.

GLEANINGS.

Tobacco in Great Britain. — In 1841 26,000,000 Britishers used 23,000,000 pounds of tobacco. Now 37,000,000 use 53,000,000 pounds.

Deserted Farms in England. — A correspondent of the *Agricultural Gazette* gives a list of seventy-five farms within sight of his residence, thirty miles from London, comprising 21,472 acres, all of which is without a tenant, and much of it out of cultivation.

Grafting-Wax — The so-called "French Mastic," so long known as "Lefort's liquid grafting-wax," is made by melting one pound of common rosin over a gentle fire, and stirring in one ounce of beef tallow. Take from the fire, and, when it has partially cooled, mix in eight ounces of alcohol. If this cools it off too rapidly, it must again be placed over the fire; but great caution must be used to keep the alcohol from taking fire. When well incorporated and cool, put in tin cans or glass bottles, and keep well covered or corked. This was, until quite recently, kept a secret, and the "mastic" imported from France.

The Raspberry, under the name of "hindberry," occurs in the eleventh-century vocabulary as an herb. It was probably the wild variety, and may have been used for distillation. The strawberry is in the same list. The white strawberry, Bacon, in his *Sylva Sylvarum*, 1627, seems to prefer to the red, just as he does the white currant, white raspberry, and white grape But the ordinary red variety is, of course, the favorite at present, and will remain so. It has a superior flavor to the white one, which is very common in Ireland, and used to be much grown in England.

The Popular Science News.

BOSTON, DEC. 1, 1887.

JAMES R. NICHOLS, M.D.
WILLIAM J. ROLFE, Litt.D.
AUSTIN P. NICHOLS, S.B. } Editors.

All new subscribers remitting $1.00 before Dec. 15 will receive the last three numbers of the present year free of charge. Dr. Nichols's book, "Whence, What, Where?" is also given as a free premium to all NEW *subscribers at $1.00.*

☞ *Those desiring this premium should make a special request for it at the time of subscribing, or there may be delay in sending it.*

Those wishing to subscribe for other periodicals in connection with the POPULAR SCIENCE NEWS *are recommended to examine the "Clubbing List for 1888," which will be found in the advertising columns. Several changes in the prices since the last season should be especially noted.*

With the close of another year, the editors and publishers of the *Popular Science News* feel that they can congratulate themselves both on the constant improvement of the paper, and for the hearty support given it by its old subscribers, as well as the numerous new ones who have been added to the list the present year. The long list of special contributors, all of whom are prominent in scientific and literary circles, is in itself a testimonial to its high standing and great usefulness. During the coming year no pains will be spared to make the paper more valuable and interesting than ever before. The same editors will remain in charge; and nearly all the special contributors of the past year, with many new ones, will furnish original papers upon matters of scientific interest. We would also call attention to the annual bills enclosed in the present number, and remind our readers that an early return of them to this office, with a check, draft, express or postal money-order, or cash in a registered letter, for the amount due, will be highly appreciated. Finally, we would suggest, that, if every reader will send us one new subscriber every year, it will be but a short time before the subscription list will be perfectly satisfactory to us in point of numbers.

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The fastest rate of speed attained by a railroad train has been a matter of considerable dispute. A few trains, both in this country and in England, make regular runs for a short distance at a rate of sixty miles an hour, although the number of trains that average forty miles an hour is very small. It has been doubted if it were possible to attain a speed of much over sixty-five or seventy miles an hour, even under the most favorable conditions. A correspondent of the *English Mechanic*, however, writes, that, during a recent journey on one of the regular express trains of the Great Northern Railway, seven miles were covered in 5 minutes 29 seconds, twelve miles in 9 minutes 37 seconds, and fifteen miles in 12 minutes and 14 seconds. Seventy miles of the journey only occupied 69 minutes and 39 seconds; and for a short distance, a measured speed of *eighty miles an hour* was attained. These figures, which are undoubtedly reliable, are somewhat astonishing; and it is probable that few American roadbeds are built with sufficient solidity to withstand the enormous strain exerted by a train travelling at such a rapid rate.

—•—

One of the most amusing superstitions regarding the serpent tribe is the widespread belief that certain snakes have the power of breaking themselves into segments, and afterwards reuniting again. A species common to the western part of the country, known as the glass snake, is especially credited with this power. One of these animals was recently dissected at the Central Park Museum in New York, and was found to differ in no respect from other snakes, except that the tail was unusually long in proportion to the body. It is quite possible that the vertebral segments of the tail might be broken off by a blow, but under no circumstances could the severed parts come together again. In referring to this matter, a correspondent of the *Scientific American* relates that on a certain occasion an earwig was cut into two pieces, and the separate parts placed on a table. The head part made a journey around the table, and then "backing up" to the posterior segment, joined itself together, and moved off as if nothing had happened. This entertaining tale is given soberly, as an actual fact; but we think it will be safe to let our readers judge of the truth of the story for themselves.

—•—

The latest scientific hoax, and one that has been very widely circulated by the daily journals, is the reported discovery by a Russian chemist of a remarkable explosive, called by the wintry name of "sleetover." This substance is said to be many times more powerful than dynamite, and to possess the peculiar property of only exerting its force in one direction — we presume the direction is determined by the exercise of a sort of "mind-cure" by the gunner. The fundamental law of physics, that action and reaction are always equal, is entirely set aside by this novel explosive, which can be fired from a wooden or even a paper tube, thus dispensing with heavy and cumbrous iron cannon. Probably the hat or boots of the commanding general could also be pressed into the artillery service, if necessary. An army having command of such a destructive agent would certainly be almost unconquerable, but we do not think that a battery of "sleetover" guns will ever be added to the numerous destructive agencies of modern warfare.

—•—

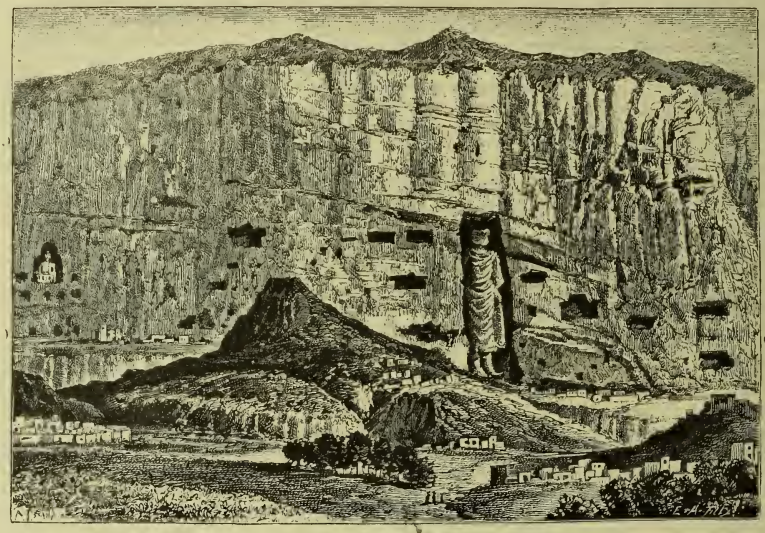
No one should fail to read the article, published in this number of the *News*, upon "Ancient Metal-Workers in the United States." Dr. Brinton is the highest authority upon American archæology, and any thing from his pen is certain to be of unusual interest.

ASTROLOGY IN SHAKESPEARE.

Astrology is one of the most ancient of sciences — more ancient than astronomy; the early development of the true science, as in the case of chemistry and alchemy, being largely due to the prevalence of the false one. The study of the positions and motions of the heavenly bodies was long subservient to the prediction of human fortunes by these celestial phenomena. We find the belief in this connection between the starry heavens and our lower world among the Egyptians, Chaldæans, and other nations of the East at the very dawn of history. It spread among the Jews in the time of the Babylonian Captivity. Later it extended westward to Rome, and in the time of Ptolemy the astronomer, was almost universally accepted throughout the empire. The followers of Mohammed eagerly adopted it, as did many of the early Christians. The Catholic Church condemned it as a relic of paganism, but it nevertheless came to be a part of the secular creed of medieval Europe. In the sixteenth century the great majority of learned men studied and practised it; and all classes, from kings down to the meanest of their subjects, were devout believers in it. It was not until the middle of the next century that it began to lose favor, at least with the educated classes. William Lilly, who was born in 1602 and died in 1681, was the last, as he was the most famous, of the great English astrologers. At first a Royalist, he afterwards became a Roundhead, and was as much patronized by Cromwell as he had been by Charles I. Towards the end of the Protectorate he predicted the Restoration, thus shrewdly getting back to the winning side. A prophecy in his famous almanac was interpreted as relating to the Great Fire of 1666; and, that event being at first ascribed to a Popish plot, he was arrested, as possibly concerned in the conspiracy, but was finally acquitted of the charge. His almanac continued to be published under his name for some years after his death, but the general acceptance of the Copernican system was a death-blow to the faith in astrology. While the earth was assumed to be the centre of the universe, the orbs revolving about it might be supposed to have something to do with the fate and fortunes of its inhabitants: but when the insignificant part the planet plays in the great system came to be understood, the absurdity of this notion was evident. Astrology, however, like kindred fallacies and superstitions, died hard, and still maintains a lingering vitality among the ignorant. Advertisements of professors of the science are to be found in the newspapers even now, and there must be a sufficient number of believers in the delusion to make the business a paying one.

In Shakespeare's day, as we have intimated, astrology had not yet fallen into disrepute. Even Kepler (who was born only seven years later than the dramatist), though he saw the unstable basis on which the science rested, did not venture to deny that there might be a connection between the positions of the planets and the natures and tendencies of persons born

under them. Bacon, though he makes only casual allusions to astrology, appears to have given a certain credence to it. In his *Colours of Good and Evil*, 7, after remarking that "things of greatness and predominancy, though they do not extenuate the things adjoining in substance, yet they drown and obscure them in show and appearance," adds: "And therefore the Astronomers say that whereas in all other planets conjunction is the perfectest amity, the Sun contrariwise is good by aspect, but evil by conjunction." In the 9th *Essay* he quotes astrologers in the same breath with the Bible: "We see likewise, the Scripture calleth envy an *evil eye;* and the astrologers call the evil influences of the stars *evil aspects.*" In the 58th *Essay* he says: "It is manifest that the northern tract of the world is the more martial region; be it in respect of the stars of that hemisphere, or of the great continents that are upon the north," etc. Here he clearly admits that the astrological explanation may be the correct one; and in another part of the same essay, referring to "vicissitudes or mutations in the superior world" (that is, among the heavenly bodies), he says: "It may be, Plato's Great Year, if the world should last so long, would have some effect — not in renewing the state of like individuals (for that is the fume [the empty fancy] of those that conceive the celestial bodies have more accurate influences upon these things below than indeed they have), but in gross." Here he distinctly implies that the stars have an influence on "things below," though some persons go too far in accepting certain details of the Platonic notion of the "Great Year."



The Largest Statue in the World. — See Page 179.

But Shakespeare, whom it is the "fume" of sundry "cranks" of our day to regard as a mere mask for Bacon, was not a believer in astrology, if we understand certain passages in his works. Cassius in *Julius Cæsar*, i. 2. 140, says: —

> "The fault, dear Brutus, is not in our stars,
> But in ourselves, that we are underlings."

There it might be a question whether we have the utterance of the poet himself; but the soliloquy of Edmund in *Lear*, i. 2. 148 fol., seemed to be introduced for no other end than to ridicule the pretensions of astrology. Gloster has been enlarging upon the evils portended by the "late eclipses in the sun and moon;" and after he goes out, Edmund soliloquizes thus: "This is the excellent foppery of the world, that, when we are sick in fortune — often the surfeit of our own behaviour — we make guilty of our disasters the sun, the moon, and the stars: as if we were villains on necessity; fools by heavenly compulsion; knaves, thieves, and treachers, by spherical predominance; drunkards, liars, and adulterers, by an enforced obedience of planetary influence; and all that we are evil in, by a divine thrusting on." Edmund's philosophy is better than Bacon's; he knows that his villany is his own, and that he cannot extenuate it by charging it to the stars.

But if one takes the ground that here it is Edmund and not Shakespeare who sneers at astrology, we have in the 14th *Sonnet* an unmistakably personal utterance of the poet: —

> "Not from the stars do I my judgment pluck;
> And yet methinks I have astronomy,
> But not to tell of good or evil luck,
> Of plagues, of dearths, or seasons' quality;
> Nor can I fortune to brief minutes tell,
> Pointing to each his thunder, rain, and wind,
> Or say with princes if it shall go well,
> By oft predict that I in heaven find."

The only astrology he believes in, as he goes on to say, is such as he deduces from the indications of those "constant stars," his young friend's eyes; in other words, a rhetorical or metaphorical astrology, like that which the poets will probably make use of till the end of time.

In this sonnet we have the only instance of the word *astronomy* that occurs in all Shakespeare's works; and we see that it is equivalent to *astrology*. So *astronomer* means *astrologer* in the only two passages in which he uses it, — *Troilus and Cressida*, v. 1. 100: "When he performs, astronomers foretell it;" and *Cymbeline*, iii. 2. 27: —

> "O, learn'd indeed were that astronomer
> That knew the stars as I his characters;
> He'd lay the future open."

Astronomical appears only in *Lear*, i. 2. 165 ("a sectary astronomical"), where it means *astrological*. Neither *astrology* nor any derivative of the word is to be found in Shakespeare.

Astrological terms and allusions occur frequently in the plays and poems. *Aspect*, for example, which Bacon uses above, was a technicality of the science, and is employed several times in that sense; as in *Sonnet* 26 (accented on the second syllable, as regularly then): —

> "Till whatsoever star that guides my moving
> Points on me graciously with fair aspect."

Influence is another technical term which Shakespeare uses eleven times in its astrological sense, and only twice with its ordinary meaning. *Predominant* occurs twice, in both instances with its specific astrological significance. The following dialogue in *All's Well*, i. 1, is worth quoting: —

> "*Helena.* Monsieur Parolles, you were born under a charitable star.
> *Parolles.* Under Mars, I.
> *Helena.* I especially think, under Mars.
> *Parolles.* Why under Mars?
> *Helena.* The wars have so kept you under that you must needs be born under Mars.
> *Parolles.* When he was predominant.
> *Helena.* When he was retrograde, I think, rather.
> *Parolles.* Why think you so?
> *Helena.* You go so much backward when you fight."

Predominance we have twice as an astrological term (as in the quotation from *Lear* above) out of three instances in all.

Of the sixteen references to *planets*, thirteen are astrological, as are the only two examples of *planetary*, one of which is quoted above. Of the many instances of the noun *star*, more than thirty have reference to the influence of the stars on human fortune. The verb occurs only in *Winter's Tale*, iii. 2. 100: "Starr'd most unluckily."

Of the instances in which particular planets are mentioned by name, the majority are astrological; as "littered under Mercury" (*Winter's Tale*, iv. 3. 25), "born under Saturn" (*Much Ado*, i. 3. 12), etc. Among similar references to the signs of the zodiac, we may quote *Twelfth Night*, i. 3, where, after

Sir Toby has praised Sir Andrew's leg, the dialogue proceeds thus: —

"*Sir Andrew.* Shall we set about some revels?

Sir Toby. What shall we do else? were we not born under Taurus?

Sir Andrew. Taurus! that's sides and heart.

Sir Toby. No, sir, it is legs and thighs. Let me see thee caper."

The reference here is to the ancient astrological figure of the human body, with lines radiating from its various parts to the symbols of the zodiacal signs. This may still be seen in that classic annual, *The Old Farmer's Almanac;* and in the column devoted to the "moon's place" in the calendar pages, the names of the parts of the body are given instead of the corresponding signs. It may be noted that Sir Andrew and Sir Toby are both wrong in the parts they assigned to Taurus. The latter either burlesques the former's ignorance, or takes advantage of it for the sake of argument. Taurus was supposed to govern the neck and throat.

Much more might be said of astrology in Shakespeare; but this familiar article is already longer than we intended to make it, and we must leave the reader to follow out the subject for himself, if he is interested in doing so.

THE LARGEST STATUE IN THE WORLD.

Near the small town of Bamian in Afghanistan, at the foot of the Hindoo-Koosh chain of mountains, several colossal statues were discovered about a year ago, which in point of size excel any representation of the human form ever carved by the hand of man.

The valley in which Bamian in situated is bordered by precipitous cliffs of a hard conglomerate rock; and in the sides of one of the cliffs five immense statues have been cut out of the solid rock, the largest of which is no less than a hundred and seventy-three feet in height. When it is remembered that the statue of Liberty in New York harbor is but a hundred and thirty-seven feet high, the immense proportions of this remarkable work of antiquity will be better appreciated. The engraving (see p. 178), which originally appeared in the *Illustrated London News*, gives a view of the town of Bamian, with one of the statues standing in its niche in the rock. The interior of this niche was covered with paintings of human figures, some of which are still well preserved.

Rude galleries and staircases are cut in these figures, by which access can be gained to the heads, the same as in our modern colossal statues. Some time after the completion of the statue, its draperies were formed by masses of stucco moulded into their proper shape and fastened to it. Numerous holes, still visible, are said to have been made, for the purpose of holding the stucco in place.

The general appearance of these statues indicates that they were the work of the Buddhist monks, who were very numerous in this region about the time of the Christian era. The largest one at least was doubtless meant to be a representation of Buddha. They were probably made about nineteen hundred years ago. Alexander the Great passed through this valley in the fourth century before Christ, but the historians of his expedition make no mention of them. A Chinese pilgrim, Huen Tsang, visited Bamian about 630 A.D., and gave the first description of which we have any knowledge; but even then the statues were very old, and the handful of monks remaining would have been utterly incapable of performing such an immense work.

It is to the modern English and Russian explorers that we are indebted for the rediscovery of these remarkable monuments, which are certainly worthy of being ranked among the ancient wonders of the world.

[Specially reported for the *Popular Science News* from the Observatory of the College of New Jersey.]

ASTRONOMICAL PHENOMENA FOR DECEMBER, 1887.

During the month of December scarcely any of the planets are visible in the evening, but the morning sky is unusually rich. Just before sunrise in the early part of the month all of the planets except Neptune are above the horizon at the same time; Mercury and Jupiter low down in the eastern horizon; Venus and Uranus higher, in the neighborhood of Spiea (*Alpha* Virginis); Mars near the meridian; Saturn in the west in the constellation Cancer; while Neptune has set about an hour before sunrise. Mercury is a morning star, and reaches its greatest elongation west on the morning of Dec. 6, when it rises about an hour and a half before the Sun, and may possibly be seen in the early morning twilight for a few days. On the morning of Dec. 4 it passes to the north of Jupiter at a distance of about three diameters of the Moon. Venus is a morning star, rising from three to four hours before the Sun. It reaches its greatest distance from that body, a little less than 47°, on Dec. 2. Mars is gradually coming nearer and growing brighter, and will be quite a conspicuous object during the winter. It is in the constellation Virgo, and during the month will move from a point a little to the east of *Beta* toward Spica (*Alpha* Virginis), at the end of the month being about 10° nearly vertically above the latter star in the early morning, and easily distinguished from it by its ruddy color. On Dec. 1 it rises about 1 A.M., and on Dec. 31 about midnight. Jupiter passed conjunction on Nov. 9, and is now a morning star, rising a little less than an hour and a half before the Sun on Dec. 1, and three hours before on Dec. 31. Saturn is in the constellation Cancer, and is slowly retrograding. It lies between Regulus (*Alpha* Leonis) and Castor and Pollux, rather nearer the latter stars. It rises at about 9 P.M. on Dec. 1, and at about 7 P.M. on Dec. 31. At midnight on Dec. 4 the Moon will pass quite close to Saturn on the south, and in the southern hemisphere there will be an occultation of the planet. Uranus is a morning star about 5° above Spica (*Alpha* Virginis). Neptune is south, and a little east of the Pleiades.

M.

Princeton, N.J., *Nov.* 2, 1887.

[Special correspondence of the *Popular Science News.*]

PARIS LETTER.

The scientific circles of Paris have been very much affected of late by the death of some of the most respected of French scientists. M. Gosselin, the president of the Academy of Sciences, honorary professor of the Medical School, and a very eminent surgeon; and M. Boussingault, also a member of the Academy of Sciences, and a chemist whose works are of utmost importance for chemistry, biological as well as inorganic, died at a few weeks' interval. Lastly, M. Vulpian, the world-known physiologist, perpetual secretary to the Academy of Sciences, and professor in the Medical School, is dead also, aged sixty-one.

M. Vulpian's career is a fine one from all standpoints, — a useful one, especially. His scientific work he began quite young, — his Doctorate thesis bearing on the nervous system, which he has so constantly studied. He was assistant to Flourens, and delivered lectures in the Museum of Natural History, which were published, and met with great success, under the title of *Leçons sur la Physiologie Générale et Compari du Systeme Nerveux.* They are yet classical When Cruveilhier died, leaving the chair of pathological anatomy vacant, Vulpian, already a fellow of the Medical School, was proposed. A Catholic bishop, M. Maret. was very much opposed to the election, arguing that Vulpian was a materialist and atheist. This is doubtful. I have often met Vulpian during late years, and have never heard him scoff at any religious opinions. I am much inclined to believe that he entertained no positive or determined ideas concerning the matter, and did not feel disposed to accept or refuse any religious creed, — a state of mind common to a great number of scientists. He was elected; and when the chair of experimental pathology became vacant, he asked for and obtained it. He became, also, dean of the Medical School, and in 1876 member of the Academy of Sciences In 1886 he was elected perpetual secretary. He was very popular with students, being a pleasant and very upright man. As a scientist his work is very valuable He never announced a fact without being entirely sure that it was true, and was a master in experimental science. Being a physician to the Paris hospitals, he combined strong clinical knowledge with an extended physiological instruction, which gave him a very strong footing. He was, as a physician, called upon in a short interval to visit Count de Chambord and Victor Hugo during their last illnesses; but his practice was never a very great one, as he did not seek to extend it, and much preferred laboratory to clinical work. His principal contributions to science refer to the nervous system physiologically and pathologically considered, to vaso-motors, and to the physiological action of many poisons, including curara and strychnine He was much beloved by all his colleagues, and by the students, unto whom he was kind and just; and his loss is widely felt in French science, where his death leaves a gap which cannot be filled.

Dr. de Saint-Germain, one of the physicians to an infants' hospital, has recently delivered a very interesting lecture concerning diphtheria and its treatment from a hygienic stand-point. Considering that diphtheria is a very contagious disease, M. de Saint-Germain wishes that every thing should be done that can prevent contagion from the diseased to the healthy. In rich and poor classes of population this is done well enough. Rich persons can easily confine the diseased child to one room, in which none but the physician, parents, and nurse have ingress; the remainder of the family being confined to another part of the house. In poor

classes it is yet better. The hospital receives the diseased, where they obtain the best care available. But not so in the middle class, where lodgings are small, where rooms are crowded on each other, and where confinement is practically impossible. In view of preventing the contagion which is the fatal result of such close promiscuity, M. de Saint-Germain proposes erecting a number of special hospitals, or barracks, devoted to diphtheritic cases, and asks for a special legislation concerning the latter. The legislation would run thus: None shall be allowed to keep a diphtheritic patient at home under a penalty of a fine of from a hundred to four hundred dollars. As soon as a case is signalled, it must be made known at once to one of the twenty *mairies* (mayor-houses) of Paris, whence the order shall be immediately issued to go and fetch the diseased, and bring him to the nearest barrack.

These barracks would be eight in number; each would comprise some twenty double rooms, — twenty for the patients, twenty for the parents; one physician, one assistant, four nurses, etc. No single employé of the barracks, from the physician to the warden, would be allowed to leave the barracks during the time of his engagement (one year); all would be well paid, of course. No communication at all could be held between the inmates of the barracks and persons of the outer world; all provisions, for instance, would be deposited in a special apparatus at the door, where the inmates would go and get them. No visits would be allowed, of course, but only telephonic correspondence. In this manner the eminent surgeon believes that the spread of diphtheria could be prevented; and his plan meets with much approval, although it may perhaps not be a very easy one to carry into execution.

IN a recent number of the *Annales de l'Institut Pasteur* M. Chamberland has published a very interesting paper concerning the influence of some essences on bacteria, and especially on the *Bacillus anthracis*. From his experiments some do not interfere with the bacillus, — such are iris, matico, parsley, pepper, rose, and vetiver essences, — but most of them do interfere, and some kill the bacillus completely, such as geranium, origanum, vespetro, *Archangelica*, etc. M. J. Bardach contributes also a paper showing that the milk of a rabid woman, when inoculated to rabbits, confers rabies, although it does no harm to the child nursed by her. But the passage of the rabic virus in the milk is not a constant fact, as has been shown by experiments in Pasteur's laboratory. It seems, from experiments performed in this laboratory, that the rabic virus may also exist in the tears, spleen, and other glands or secretions.

PROFESSOR VERNEUIL has recently issued the first volume of the periodical which is called *Études Experimentales et Cliniques sur la Tuberculose*, and is, as the title shows, entirely devoted to the study, treatment, and prophylaxis of tuberculosis. The volume will appear, according to the supply of material, at irregular periods. MM. Raymond and Arthaud contribute a paper on the prophylaxis of this disease They do not believe in the possibility of any preventive vaccination against tuberculosis, but think that, by mixing tannin or tannic acid with the food, one may put the organism in very favorable conditions of resistance against tubercular infection. They have given rabbits tannin at the dose of a gram *pro die*, and have seen, that, as Gohier had announced, the tissues of the animals, when killed, become quite imputrescible: they do not decay, but become dry. Rabbits which have been subjected to the tannin treatment are rendered pretty refractory to the development of tuberculosis when tubercular bacilli are inoculated. MM. Raymond and Arthaud's experiments are rather incomplete yet, but encouraging, and it is to be hoped that they will be continued.

THE Société de Psychologie Physiologique is at present engaged in a very interesting study concerning hereditary transmission, especially from the mental stand-point. It has prepared, with the co-operation of Professor De Candolle of Geneva and M. Taine, the eminent philosopher, a summary of questions to be answered, which enable each person to carry on the investigation on himself and his parents or children. The questions refer in each case to social and religious standing, to physical, physiological, and pathological features of the person upon whom the investigation is carried, and to the moral and intellectual state. The point upon which the investigation bears mainly is the presence or absence of a very strong likeness in any department between parents and children, either young or grown up. The investigation is a very interesting one, but I really do not know whether it will place any new facts in light. It may confirm many hitherto vague statements and opinions, but it is improbable it will do more. At all events, this is well worth having.

H.

PARIS, *Oct.* 21, 1887.

[Special correspondence of the *Popular Science News*.]

BERLIN LETTER.

SOME interesting experiments in ballooning were lately performed in the Waldschlösschen Park near Dresden. The subject of the navigation of the air for military purposes has long engaged the attention of both France and Germany; and now a scientist of the latter country has, it would appear, completed an invention that may prove of great service to aeronautics. I refer to the *lenkbares Luftschiff* (governable air-ship) of Dr. Wölfert. In his trial trip he guided his balloon at will, and that, too, even against the wind, over a distance of a hundred and fifty meters, at an elevation of ten to twenty meters, the weather being moderately calm. The shape of the balloon may be described as ellipsoid-cylindrical, with sharply tapering ends; the long axis being horizontal. The length is 17.2 meters, the greatest diameter 4 85 meters, and the capacity 190 cubic meters; hydrogen gas is employed to inflate it, and it is capable of raising 230 kilograms, or a little over 500 pounds. The aeronaut sits somewhat as on a bicycle, with his feet braced firmly against the two parallel rods which form what we may call the floor of the skeleton-like car, while between his knees is a cogged wheel, to which are attached two cranks. At the forward end of the car, and beneath the tapering extremity of the balloon, is the fan-like screw or propeller, a simple device somewhat on the principle of the windmill; directly under the car is another similar propeller, at right angles to the former. By turning the cranks in front of him, the balloonist causes one or both of the propellers to revolve; two hundred and fifty revolutions per minute may be attained, and in either direction. By communicating-rods the driver may cause the horizontal propeller to point either right or left, and thus change the balloon's course without the use of a rudder; while, by setting the vertical propeller in motion, he raises or lowers the balloon at pleasure. Indeed, the descent is always effected in this manner, thus obviating the necessity of letting off the gas. The balloon is firmly enclosed in a manilla net, and twenty-five ropes pass over and through the inflated body in such a manner as to secure a remarkable degree of steadiness for the car. As this matter of stability has always been one of the most difficult points in the construction of a governable balloon, Dr. Wölfert is careful to guard his secret, and we are unable to give any fuller particulars.

The inventor proposes to apply the principle of this trial-balloon to larger ones for various uses in time of war. The car extending under the long body of the balloon will be of a convenient shape, and he hopes to launch an air-ship that will hold fifty men. It is to be 31 meters long, 10 meters in its greatest diameter, holding 1,456 cubic meters of gas, and capable of bearing 1,763 kilograms of weight. The lightest and finest gas-tight Persian silk is to be used in its construction, weighing 147 kilograms; the gallery-like car to be 20 meters long, and made of bamboo and ropes; and the propellers to measure 3 5 meters in diameter. To keep the balloon perfectly taut, an air-bag will be placed inside, called the "compensation balloon." As man-power will no longer suffice, and as steam-power would require the carrying of too much weight, the inventor proposes to equip his balloon with an electro-motor, which will be of twelve-horse power. The French balloonists Renard and Krebs have already employed electricity, but their motor was too heavy to be practicable. Dr. Wölfert's motor is to weigh but half as much, and one of England's best electricians guarantees success as far as that is concerned.

TWO Berlin photographers, Gaedeke and Miethe, have recently made improvements in the art of photographing by artificial light. The imperfections in the magnesium light have been hitherto: first, the difficulty of obtaining a perfectly uniform and steady light during the period of exposure, this difficulty arising from the impossibility of making magnesium strips of exactly uniform size throughout, whereas a perfect control of the intensity of illumination, on both the light and shade sides, is indispensable to the faithful reproduction of expression; second, the dazzling nature of the light renders it impossible for the sitter to preserve a natural expression during the exposure; third, the process always fills the room with clouds of magnesia. These obstacles are obviated by Gaedeke and Miethe by the use, not of magnesium strips, but of a mixture of magnesium powder, sulphuret of antimony, and chlorate of potash. The sulphuret of antimony facilitates ignition, while the chlorate of potash, by giving off oxygen, causes the magnesium to burn with greater brilliancy. The mixture is burnt in a lantern, the generated gases expelling the air through an escape-pipe, and themselves remaining. When the process is completed, the lantern is taken to the window, and the smoke and gas blown off. With this mode of illumination an exposure of from two to three hundredths of a second is found to be sufficient, and thus the most life-like expression of countenance may be caught. The suddenness and intensity of illumination calls forth no look of surprise in the sitter before the whole thing is over. The pupil of the eye, too, is taken at its largest, as it was in the darkness preceding the flash of light.

NEWS comes from Copenhagen that the Danish expedition which started out in the spring of 1886 under command of marine officer Ryder, to explore, survey, and map Northern Greenland, has lately returned. During the two summers measurements and maps were made covering degrees 72–74½, the northern limit being forty-five miles from the last Danish settlement. Journeys by sledge were undertaken during the winter, the rate of motion of the Upernivik glacier being

measured, and astronomical observations conducted. The party has brought back valuable, and in some cases new, botanical and zoölogical specimens. The surveying of the western coast of Greenland is now completed.

The experiments of Nahrwold and other electricians seem to demonstrate that the atmosphere, when free from foreign matter, cannot hold electricity nor serve as a conductor. The floating particles of dust are, it would appear, an important element in the phenomena of a thunder-storm, the passage of which always leaves the air so clear and clean. Audries's theory of the peculiar danger from lightning in a manufacturing town, with its smoke-laden atmosphere, would thus be scientifically verified.

Another note of interest from the far North reports the passage, on the 7th of this month, of the first railway train across the arctic circle, and the completion of the Lulea-Ofoten Railroad to within four Swedish miles of the famous iron-mountain Gellivara.

P. F. Bicknell.

Berlin, *Oct.* 21.

[Specially reported for the *Popular Science News.*]

METEOROLOGY FOR OCTOBER, 1887.

TEMPERATURE.

Average Thermometer.	Lowest.	Highest.	Range.
At 7 A.M.	42.39°	21°	58°	37°
At 2 P.M.	57.65°	44°	74°	30°
At 9 P.M.	46.00°	27°	62°	35°
Whole month	48.68°	21°	74°	53°
Second average	48.01°	21°	74°	53°
Last seventeen Oct's	50.99°	47.29°, in 1876.	56.16°, in 1879.	8.87°
Second average	50.42°	46.72°	55.38°	8.66°

The coldest day of the month was 34°, on the 30th. The following day averaged only two-thirds of a degree warmer. The 10th was the warmest day, with an average of 64½°. The lowest point reached at the hour of observation was 21°, on the morning of the 31st; the highest was 74°, at 2 P.M. on the 10th. The entire month was 2.31° below the average for the last seventeen Octobers, only two of which have been less warm than the present. The range in seventeen Octobers has been 8.87°, while the present was 7.48° below the warmest in 1879. Frosts have occurred on about one-third of the mornings, generally quite slight. The most severe was on the 31st. The last three months have averaged over 3° cooler than usual for seventeen years. May we not expect an early winter?

SKY.

The face of the sky in 93 observations gave 46 fair, 25 cloudy, 16 overcast, and 6 rainy, — a percentage of 49.5 fair. The average fair for the last seventeen Octobers has been 57.8, with extremes of 43, in 1882, and 73.1, in 1874. Only two Octobers in seventeen years have been as cloudy as the present. Three mornings were foggy, — the 4th, 20th, and 29th. An intelligent neighbor reports having witnessed a "lunar rainbow" on the 2d, — a rare privilege. A few warm, fine October days were noted, but not so numerous as usual. The month ended with a beautiful sunset.

RAIN.

The amount of rainfall the past month was only 2.36 inches, while the average for the last nineteen Octobers has been 4 inches, with extremes of .75, in 1876, and 13.20, in 1869. The rain fell mostly on the 21st. No thunder was noted during the month. The whole amount of rainfall since Jan. 1 has been 37.79 inches, while the average up to this date has been 37.88, — a close figure.

PRESSURE.

The average barometer the past month has been 29.976 inches, with extremes of 29.52, on the 21st, and 30.40, on the 27th, — a range of .88 inch. The average pressure of the last fourteen Octobers has been 30.002 inches, with extremes of 29.826, in 1875, and 30.109, in 1886. October stands next to September for high pressure, having exceeded an average of 30 inches seven times in the fourteen years. The sum of daily variations the past month was 5.22 inches, — an average daily movement of .168 inch. This average in fourteen Octobers has been .162, with extremes of .113 and .211. The largest daily movements were .50, on the 24th, a very windy day; .46, on the 21st, in connection with 1.22 inches of rain; and .4, on the 22d, also noted windy. The barometric changes increase as the winter months approach.

WINDS.

The direction of the wind in 93 observations gave 14 N., 0 S., 14 E., 28 W., 5 N.E., 15 N.W., 3 S.E., and 14 S.W., — an excess of 17 northerly and 35 westerly over the southerly and easterly, and indicating the approximate average direction of the month to have been W. 25° 54′ N. The westerly winds in October have uniformly prevailed over the easterly, the last eighteen years, by an average of 30.06 observations, and the northerly over the southerly, with four exceptions, by an average of 6.39; indicating the general average direction for October to be W. 10° 56′ N. The longitudinal extremes in eighteen Octobers have been 4 and 56 W., — a range of 52 observations; and the latitudinal 30 N. and 30 S., — a range of 60. The relative progressive distance travelled by the wind the past month was 38 91 units, and during the last eighteen Octobers 606 such units, — an average of 33.67; showing less opposing winds than usual. By the above it will be seen that the winds the past month have been nearly 15° more northerly than usual; hence the cooler weather.

D. W.

Natick, *Nov.* 5, 1887.

QUESTIONS AND ANSWERS.

Letters of inquiry should enclose a two-cent stamp, as well as the name and address of the writer, which will not be published.

Questions regarding the treatment of diseases cannot be answered in this column.

S. F. H., *New York.* — Do bees gather honey from flowers, or do they make it from the nectar of the blossoms?

Answer. — Honey and flower-nectar are the same substance; and the bees simply gather it, without changing it in any way. Wax, on the contrary, is a secretion of the organism of the bee. Several pounds of honey are required to make one pound of wax.

Machinist, *Boston.* — How can I cleanse my hands from the oil, iron rust, filings, etc., which are absorbed by the skin, and upon which ordinary soap and water has but little effect.

Answer. — The following method, which is used in Germany, may be effective: First rub the hands with warm oil, and, when this has thoroughly penetrated, rub them with powdered borax. Subsequent washing with soap and water makes the hands perfectly clean.

F. J., *Iowa.* — What makes the forked stick, or "water-witch," turn in the hands of certain well-diggers?

Answer. — The cause of this movement is not known, and it belongs to a class of natural phenomena which has never been thoroughly investigated. Various explanations, such as electricity, magnetism, "vital force," unconscious muscular action, etc., have been suggested, but, with the possible exception of the last, have no bearing upon the subject. It is not probable that it really indicates the presence of water; and the same method is used by different persons for locating oil, natural gas, ore deposits, and (alleged) currents of electricity in the soil. It is a curious phenomenon, but of no value for indicating the presence of any thing below the earth's surface.

W., *New York.* — The recipe for "a *good* ink" on p. 160 of the November number should doubtless read *six* ounces of logwood extract instead of *sixty*, although sixty is according to the original copy.

LITERARY NOTES.

Quantitative Chemical Analysis by Electrolysis. By Dr. Alexander Classen. Translated by William Hale Herrick, A.M. John Wiley & Sons, New York, publishers.

The quantitative determination of metals by direct precipitation in the metallic state by the electric current, is one of the most convenient and accurate methods known, and is especially applicable to the work of an analytical laboratory, inasmuch as the electric current does the work of the chemist, leaving him free to carry on other operations. The method is very completely and thoroughly described by Dr. Classen in this work, which every chemist will find of great value.

The same firm have also published an *Elementary Text-Book of Physics*, by Professors William A. Anthony and Cyrus F. Brackett. It is intended as a text-book for schools and colleges, but is hardly elementary enough in its character for beginners in the lower schools. For students already possessing some knowledge of algebra and physics, it will prove a most excellent work.

They also publish a *Primary Geometry*, by S. Edward Warren, with special reference to plane and projection drawing. It is written in a plain and simple style, which is well adapted to the comprehension of beginners, and is very practical in its applications of the science.

A Manual of Analytical Chemistry. By John Muter, Ph.D., F. Blakiston, Son, & Co., Philadelphia. Price $2.00.

This work contains a complete scheme of qualitative analysis, with a description of all the most important processes of quantitative analysis both of inorganic and organic substances. A valuable feature is the scheme of qualitative determination of the acids, which goes on in a direct course like that of the metals, successfully detecting all the acids in one direct line of experiments. It is adapted to the needs of medical and pharmaceutical, as well as chemical, students.

Elementary Treatise on Analytical Mechanics. By William G. Peck, Ph.D. A. S. Barnes & Co., New York. Price $1.65.

This excellent treatise upon an important brauch of the higher mathematics was prepared for use as a text-book in the Columbia College School of Mines, and is intended for the use of students of engineering, architecture, and geodesy. The methods of the differential and integral calculus are largely made use of, and the order of arrangement is logical, the definitions clear, and the demonstrations simple and comprehensive.

The J. B. Lippincott Company of Philadelphia have issued a third edition of the well-known *Elements of Modern Chemistry*, by the late Professor Wurtz. The present edition is brought down to September, 1887, and contains, among other additions, the history of the isolation of fluorine, the monoxide of sodium, the Castner sodium process, and the electrical furnace.

Messrs. Lee and Shepard of Boston have published a cheap paper edition (30 cents) of that most excellent and sensible book, *Natural Law in the Business World.* Special prices will be given to those desiring to purchase a large number of copies for general distribution.

The *Report of the United States Fish Commissioner* for 1885 is at hand, and contains an immense amount of valuable information regarding the propagation of food-fishes, and an inquiry into their recent decrease in numbers.

Pamphlets, etc., received: *Loomis's Contributions to Meteorology*, reviewed by H. Helm Clayton; *A Review of the Muscles used in the Classification of Birds*, by R. W. Shufeldt, M.D.; *Recent Advances in Electricity* (price $1.00), from the College of Electrical Engineering, 122 East 26th Street, New York; *Ovarian Tumors*, by Edward Borck, M.D.; *Report of the Eighteenth Annual Meeting of the American Public Health Association*; *Prohibition, and how to make it Prohibit*, by David W. Wood; *Fifth Biennial Report of the Kansas State Historical Society*; *Calendar of the Medical Faculty of the University of Toronto*; *Agricultural Reports of the State of Massachusetts, Connecticut, and Georgia*; *Health Reports of the States of Iowa and Minnesota*; and *Reports of the United States Bureaus of Agriculture and Statistics.*

Medicine and Pharmacy.

PATENT MEDICINES.

The numberless variety of patent medicines advertised in the columns of nearly every newspaper or magazine is a striking proof of the credibility and gullibility of the human race. Scarcely a week passes by but some new remedy appears, which is guaranteed a sure and "safe" cure for any or all of the diseases which afflict mankind. Diseases, like consumption, albuminaria, diabetes, or paralysis, which are often incurable, and even in the favorable cases require the most scientific medical treatment, have no terrors for the proprietors of the widely advertised tonics, cures, pills, or "treatments." A few bottles — six for five dollars — taken according to direction are all that is necessary to cure the most desperate case, and restore the sufferer to health and life once more.

The immense amounts of money spent in advertising these preparations show that they are largely consumed; but it seems hardly possible that a person of even average intelligence can believe the statements made in these advertisements. One man claims that his "cure" will promptly and quickly cure Bright's disease; or, if the reader is in good health, the regular use of the preparation will insure him against any future attack. Another widely advertised "treatment" is said to consist of "a scientific adjustment of the elements of oxygen and nitrogen *magnetized;* and the compound is so condensed and made portable, that it is sent all over the world" — for the healing of the nations, we presume. A clear scientific explanation like this ought to convince the most sceptical invalid. But we would suggest that the "treatment" might be improved by adding a definite proportion of the "etheric molecules" used to operate the Keely motor, as they would doubtless add a great deal of "strength" to the preparation.

Instances like these might be multiplied indefinitely, but they serve to show what absurd statements are put before the public in regard to health and disease. Few of these preparations are really harmful: the manufacturers are too shrewd to make use of active or powerful ingredients. The fraud is upon the purse of the purchaser, and not upon his health, except as it may indirectly induce him, when really ill, to put his trust in some inactive nostrum, instead of seeking medical advice. Of all the secret medicines which have been analyzed, there has not one been found which contained any thing but the simplest ingredients, and which could have been duplicated by a druggist at one-half the cost.

A distinction must be made between the popular cure-all nostrums and the large number of medicinal preparations which are adapted to a definite purpose, and are of known composition. These are admitted to the advertising columns of all reputable medical journals, and are intended principally for the use of physicians. There are also many toilet and hygienic preparations which are both unobjectionable and beneficial. Even the infinite number of purgative pills may comprise some effective and well-made articles; and if any one prefers Brown's, Jones's, or Robinson's "vital granules" to the lower-priced "Pil. Cathart. Comp." of the Pharmacopœia, the ultimate effect will probably be the same in many cases. But it is certainly highly unreasonable to suppose that some hitherto unknown business-man or drug-clerk has become possessed of secrets in therapeutics which are unknown to the entire medical profession. No medicine which claims to be a specific cure for any serious disease, and is offered for indiscriminate popular use, is worthy of any confidence whatever.

We have frequently referred to the worthless character of the various electric and magnetic belts, bands, chains, etc. It is not too much to say that they are *all* utterly useless, and money paid for them is thrown away. It is impossible to develop or pass a current of electricity through the body by any of these appliances; and even if it could be done, it would not produce any remedial effect. Electricity is only of value in a limited class of diseases, and, to be of any benefit, should be used according to the directions of a physician familiar with its application.

As to the quack doctors who advertise their alleged superhuman skill in the columns of daily and weekly newspapers, we can give but one word of advice: have nothing whatever to do with them. No reputable physician will ever advertise his cures or his practice in the public journals. The quack doctor is much worse than the patent medicine; for, while the latter will probably do little harm, the former may cause a permanent injury to health by his ignorant and unskilful treatment, and in many cases he will prove but little better than a blackmailer.

If any one is afflicted with disease, let him avoid all advertised nostrums or advertising doctors and "healers" of every description, and seek medical advice from some regular physician with whom he is acquainted, upon whose intelligence and skill he can rely. From such an one he will at least obtain an honest opinion, and, if the matter is serious, a recommendation of some competent specialist, who will give his case the necessary attention. In this way one may save both his health and his money, for the average quack doctor is likely to demand the latter article in direct proportion to his inability to restore the former.

[Original in *Popular Science News.*]

SANITARY SCIENCE AND DOMESTIC ARCHITECTURE.

BY JOHN CROWELL, M.D.

II.

Not only have we made improvement in the sanitary arrangement of our dwellings, and effected radical changes in certain mechanical appliances, but the literature upon the subject of domestic architecture has had a tendency to make men think before they build. They study, with more or less intelligence, the laws of fitness in the working of details; and hence we observe a change in the external appearance of many houses recently erected, while the interiors present a still greater departure from conventional style. As people improve in general culture and refinement, these elements will become apparent in their surroundings; and under such influence domestic architecture may rise to the dignity of a fine art No matter how gifted may be your architect, the thought of the owner of the house should enter into its construction; and each angle and buttress, and cornice, window, and porch, should have a meaning in its relation to the general effect of the plan. How many tawdry ornaments and meaningless details disfigure our houses, in the foolish desire to make them look like something else than that for which they were intended!

The idea that a house is intended for a *home* should never be lost sight of in the erection of dwellings; and hence the elements of *comfort, compactness, healthiness,* and *unpretentious elegance* should be considered.

The rigor of Northern winters makes sad work with Grecian porticos, with thin, flat roofs, and heavy wooden cornices. Sharp roofs, with quiet gables, and sunny, picturesque windows, and *slight* pediments, are better adapted to a climate where protection from storms and cold is necessary for eight months of the year. Heavy unmeaning projections, supported by a profusion of sawed brackets, are in bad taste. They are sure to invite leakage, and are discarded by all good architects. An elegant severity in the disposal of ornament is the rule to be observed, both for beauty and for practical effect. Accept no plan that does not provide for generous windows, especially upon the sunny side of the house. Quaint devices in windows, with mediæval glazing, are very picturesque; but they serve to keep out the light, and the rooms that should be full of sunshine are made gloomy and unhealthy. Odd openings for windows can be made for effect in portions of the house not designed for general use, such as closets, back entries, and stairways; but living rooms and chambers must be open to a flood of sunshine. It is a very easy matter to regulate light by shades and blinds; and the health of wife and children, who spend much of their time in the house, is of more vital moment than are the caprices of æsthetic designs.

Hence heavy piazzas, with immense entablatures, and pillars stretched along the sunny side of the house, should be discarded. They darken the rooms, and shut out the sun in the winter; and the reflected light and heat from the painted roof are very objectionable to the occupants of the chambers.

Be sure and have broad balconies in every available place convenient for out of door resort in fine weather. They invite, by their hospitable roominess, the inmates of the house to the open influences of the sunlight and the air; and in hot weather an awning can be adjusted as a protection against the blazing heat of the sun.

The hall is an important part of a house. It is not simply a place in which to hang hats and coats, and to provide a convenient landing for the chamber stairs. It should be wide, roomy, and hospitable in its arrangements, and not be obstructed by a staircase springing from the front door, and obtruding itself, with an enormous post surmounted with a pretentious gas-burner, into the face of every visitor, as if the first and only thing to be done was to go up-stairs. A hall may furnish a cool sitting room for summer days; and nothing is more inviting than the spacious halls of Colonial times, with an outlook through the rear door into the cool, refreshing verdure of the garden lawn, sprinkled with shade-trees.

It has become quite fashionable to have a fire-

place in the hall, and as a means for ventilation it serves a good purpose. The handsome mantel, the quaint devices in tilings, and the adornments of fender and fire-set, all add to the attractiveness of the apartment. But unless there is ample protection from cold draughts from the front door, such a room becomes a dangerous place in which to sit in cold weather. The ideal of baronial halls in the chivalric days of the Edwards and Henries is hardly met by the fanciful toy-shops of modern cottages, and many absurdities are grouped under the convenient title of "Queen Anne" which had no existence in the Augustan reign of that amiable but not very forcible sovereign. If the walls be sufficiently high, the hall may serve as a picture gallery, with light corridors running around the sides. With a good light adjusted from the roof, oil paintings produce a noble effect in this apartment, and no better place can be found for the display of family portraits, which are out of place in the drawing-room. Good proportions, and an airy, inviting appearance are the requisites for making this apartment a fitting entrance to a home.

In a long hall the monotony may be averted by a light arch, or by cluster columns richly decorated Do not let the desire for artistic effects tempt the owner to darken his hall with heavy draperies. However beautiful the fabrics may be, they keep out the light, and accumulate dust, and give to the room a cramped and suffocating aspect, at variance with the conditions of airiness and cheerfulness.

Assuming, then, that the exterior of the house is homelike and attractive, — that it has no vulgar pretension nor gaudy cheapness in its construction and ornamentation, — and keeping in view the fundamental idea that the house is intended for a *home*, we are prepared to speak of the principal rooms, and of the first importance is the living or sitting room. This room should be upon the sunny side of the house; it should have a spacious opening from the hall, and should be of generous dimensions, with plenty of light. The dimensions of a sitting-room should not be less than eighteen by fifteen feet, with a height of ten feet and a half. If the family is large, and especially if there are young children, the size of this room may be still larger.

The walls should be bright and cheerful, and the great flood of light from the large windows will admit of much variety in colorings, always avoiding heavy cornices with shelving members for the collection of dust and cobwebs, and massive stucco ceiling decorations. The finish of this room should not be too dark. Black walnut or dark grainings should be avoided, but ash, oak, maple, or birch may be used, or perhaps pine mouldings painted in particolors. This room will not be perfect without a fireplace. Be sure and have a generous chimney, and an open fireplace for the burning of wood or coal. The mantel may be of the same material as the wood-finish of the room, with a contrast of tile border. It is desirable to break up the tedious sameness of the white-marble mantel. The carpet should be of firm material, of severe pattern, and with but a few, but cheerful, colors. The desire for draperies may induce one to hang the windows with heavy lambrequins, they are so dressy, and add so much to the rich coloring of the room; but they must be ruthlessly discarded from this apartment. They obstruct the light, and collect dust, and interfere with the circulation of air around the windows. Reserve these adornments for more stately rooms. Inside shutters are convenient for the adjustment of light, and they afford much protection from the cold in winter evenings, and give a snug, cosy look to the room. Bearing in mind these general principles, this room may be made one of the most delightful and attractive in its appearance, and with enough of individuality to give to it a distinctive character, and not be an exact copy, in all its details, of your next-door neighbor.

Haverhill, Mass., *November*, 1887.

[Specially compiled for the *Popular Science News*.]

MONTHLY SUMMARY OF MEDICAL PROGRESS.

BY W. S. WELLS, M.D.

Professor Richelot of Paris lately read to the Société de Chirurgie the report of a case in which congenital malformation of the lower jaw rendered mastication impossible. The professor made a resection of the lower jaw, and took away, by the aid of Liston's pincers and a perforator, about two centimeters of the bone at the level of the left bicuspid teeth, making a suture with silver wire, and exact coaptation of the fragments, adapting the canine-tooth part to the molar portion. This operation was made by the mouth, to prevent exterior cicatrix; but, owing to insubordination of the patient and hysterical attacks, union of the bone did not take place, and she left the hospital with a false joint.

Some two months later the girl was received by M. Routier at the Laeunec Hospital. Routier operated by an incision made on the inferior border of the jaw; removing the fibrous tissue, scraping the fragments, and introducing a portion of calf's bone taken from the animal just killed, and immobility was secured. The reunion was made without difficulty, and bony consolidation followed. Two months later the patient was quite well, being even cured of her hysteria, as well as able to use her jaws.

M. Richelot added that he was disposed to try putting a slip of animal bone between the fragments in similar cases hereafter, as he saw the perfect consolidation that was obtained after his failure by suture, perforation, and the usual method.

Dr. Henry J. Neilson contributes to the *British Medical Journal* a paper entitled "Observations of the Pupil as a Guide in the Administration of Chloroform." He says: —

"The effects of chloroform inhalation on the pupil are at first dilatation, varying in degree and duration, then contraction as the narcosis becomes profound, and dilatation again as the sensibility is returning. So long as the pupil dilates in response to excitation by pinching, etc., the patient is not sufficiently narcotized for an operation to be proceeded with, unless it is a very slight one. When the pupil becomes strongly contracted and immobile, no more chloroform should be given until it begins to dilate again. If, then, further anæsthesia be required, a little more chloroform should be given until the pupil again contracts. The occurrence of sickness causes dilatation similar to but more sudden than that which happens when sensibility is returning, and the efforts of vomiting have the effect of arousing the patient. By observing the pupil, the administrator can tell at once when the effect of the drug is on the wane, because the pupil then begins to dilate slowly, and, by using more chloroform, can keep the patient under its influence, and avoid struggling.

This action of the pupils is a valuable auxiliary to the watching of the respiration and the pulse in cases of chloroform anæsthesia.

At the late meeting of German scientists, methods for reviving persons apparently dead were discussed. Dr. H. Frank mentioned that there were but two ways to stimulate the heart, — electricity, and mechanical concussion near the region of the heart. The first he considers dangerous, and prefers the "pectoral concussion." He operates by flexing the hands on the wrists to an obtuse angle, placing them both near each other on the ileo-cæcal region, and making vigorous strokes in the direction of the heart and the diaphragm.

These strokes are repeated from fifteen to twenty times, and are succeeded by a pause, during which he strikes the chest, over the heart, repeatedly with the palm of his hand. These movements and concussions must be persisted in for some time after resuscitation, — an hour or so, for fear of relapse. Commencing resuscitation is indicated by twitching of the lids or angles of the mouth, and revival of the circulation.

By this method Dr. Frank claims to have seen life return in fourteen cases, among which were such as had hung themselves, been drowned, or asphyxiated by carbonic oxide, and in one case by croup. In three cases of asphyxia by coal-gas, and in one case of apparent death by chloroform, this method alone succeeded.

Spigelia, or pink-root, apart from its anthelmintic properties, is said to possess other therapeutical properties worthy of trial. In small doses Professor Shoemaker has found it to act as an excellent stomachic tonic, improving the appetite and assisting digestion, even in cases where no intestinal parasites exist. It is also useful in gastralgia and in flatulent colic. Melancholia, occurring at the climacteric, may be frequently relieved by it after various other remedies have failed. Chorea and the milder forms of hysteria may be often permanently cured by the persevering employment of small doses of the same remedy.

Dr. Nitze of Berlin has devised an instrument he calls a kystoscope, for viewing the cavity of the bladder, combining au ingeniously arranged electric light with an endoscope.

This was tried by Von Bergmann in a case of tumor of the bladder, and spoken of with much praise, as being easily introduced, and not distending the urethra or neck of the bladder more than a large-sized catheter, and in his case not occasioning any hemorrhage. The bladder is made to contain a certain quantity of transparent fluid, thus opening the folds of its mucous membrane, and allowing all portions of its surface to be brought into view. The field at once visible is as large as a silver dollar; and by changing the position of the mirror in the kystoscope, the entire surface may be quickly inspected, and any abnormal condition disclosed. By the use of cocaine its use is rendered painless, and danger from heat is obviated by a circulating current of cold water.

It is expected by this instrument to supersede incisious and severe procedures for purely diagnostic purposes, and to enable one to view the actual state of the cavity of the bladder, and the size and shape of tumors or stones within.

Several cases of nutmeg-poisoning have been noted in the *British Medical Journal* during the past summer, the reporters all alluding to the scarcity of information ou this subject in works on toxicology.

A whole nutmeg was taken in four of the cases reported in the *British Medical Journal*, and five whole ones iu the remaining case.

The following is related in the *Australasian Medical Gazette*, and is regarded noteworthy, first, for the small quantity (rather over half of an ordinary-sized nutmeg) which produced the symptoms, and secondly, for the very marked effect on the heart and circulation.

The patient, a strong, healthy woman, grated the nutmeg, and mixed it with a glass of hot ale, which she drank at bedtime An hour after, she felt some nausea, but got to sleep.

Awakened about two A.M., feeling very cold and with a sensation of pricking in the skin, and with her "heart beating at racing speed."

When Dr. Pinnock of Victoria saw her, two hours later, the surface of the body was everywhere cold and pale; pupils dilated, respiration sighing, and pulse almost imperceptible and uncountable. The doctor gave her hot brandy and water immediately, and mustard applications to epigastrium and extremities; also a mustard emetic. As this did not act, he gave her, about fifteen minutes subsequently, one-tenth grain apomorphia, which produced free vomiting in a few minutes. The vomited fluids contained nutmeg unmistakably. After this the pulse strengthened, became more steady, and warmth returned to the surface. Much drowsiness continued; and, after taking some more hot brandy and water, she went to sleep. Next day she was much better, and the day after was fully recovered, and able to attend to household duties.

ROMAN FEVER.

UNDER the old *régime* in Rome little attention was paid to matters of cleanliness and decency. Nor was the science of public hygiene understood, for in those days there was little fear of this unhealthy locality. At present there is much uneasiness in the minds of travellers, and yet the improvements introduced have been such that the sanitary condition of Rome is second to that of no other city in the world.

A plentiful supply of pure water has been secured, and arrangements have been made for its diffusion in every part of the city. Drains have been enlarged and multiplied, and constructed in accordance with the regulations of modern science. New quarters of the city have been built, and vineyards, gardens, and other hotbeds of disease have been destroyed. Wide streets have been opened across the city, the houses in unhealthy localities torn down, and arrangements made for the systematic cleansing of the public ways.

Taking these facts into consideration, travellers ought to be reassured as to the sanitary conditions of the city. Unhappily, there are not a few who are not tranquillized. When they come to our city, they tremble lest they should be atta ked by illness, as if they were in a pestilential climate. If, soon after their arrival, they are disturbed by some trifling indisposition, immediately they think, "I have taken Roman fever!"

The idea that there exists an especial form of malarial disease, called "Roman fever," I believe has come to pass through the ignorance of foreign physicians practising in Rome, who are ignorant of the clinical forms prevailing in our climate, and hence make erroneous diagnoses, and adopt wrong treatment, founded upon their respective national methods. Complications and aggravations in the malady follow; and often when the patient is going to die, to the erroneous diagnosis of typhoid or typhus fever is added that of Roman fever, and just before death it is called *pernicious fever*. Thus has arisen a conception of an imaginary disease, Roman fever, — a disease unknown to Roman physicians.

In order to emphasize the assertion that Roman fever is a purely mythical idea, I would further affirm, from my own personal knowledge, that such a theory never entered into the heads of the foreign physicians who practised in Rome many years ago. And yet at that epoch Rome was not in as good hygienic condition as it is now. But the crowning proof of the salubrity of our city is the fact of its indemnity from cholera, even when the neighboring cities were seriously infected with this disease, and when a large number of emigrants were coming from these infected districts to Rome.

A large part of the strangers who come to our Italian metropolis arrive there in a suffering condition, either fatigued by the long journeys they have taken, or affected by the various changes of climate, lodging, and method of life incident to their condition as travellers, and operating with greater force during the winter season. This being so, there is not always sufficient care to secure the needed rest, especially as they are anxious to see our historic city in the shortest possible time. So they rise early and set to work, paying little attention to their enfeebled condition.

The maladies prevalent in Rome are generally of a rheumatic and catarrhal, rarely of an infective type. If the latter prevail among strangers in the city, it is not the result of the climate *per se*, but of their irregular mode of life, and of the disadvantages of not being subjected to a rational method of treatment.

Now, it may be asked with reason, What, then, is the rational treatment of these diseases among foreigners? The first thing to be done is, to remove the causes which have favored the malady. If rheumatic causes and dietetic errors have been the chief factors in determining this, diaphoretics, laxatives, sedatives, possibly oily mixtures, tepid baths, corrective draughts, a well-regulated diet, etc., should be prescribed. This mild method of treatment has almost always been found successful in these cases, which I have rarely seen degenerate into infectious, or, as they are now called, typhoid fevers. Their course has been mild and brief, ordinarily not lasting more than two weeks.

But no fact is better established than that the greater part of the strangers residing in Rome improve in health; the sufferings for which they have sought its favorable climatic influences diminishing, so that they depart showering benedictions upon Rome and all Italy.

There is, then, no such thing as "Roman fever;" the illness of a few among the many visitors who come to our city is owing to conditions peculiar to themselves, and not to the climate of Rome, or that of any other city. They fall ill wherever the forces of nature fail. — GREGORIO FEDELI, M.D., in *Phila. Med. and Surg. Reporter.*

MEDICAL MEMORANDA.

THE chief of police, Chicago, has issued an order giving the vehicles of physicians precedence at bridges, along with the mail and patrol wagons, ambulances, and fire apparatus.

IT has been calculated, according to Professor Proctor, that a man of seventy has consumed twenty wagon-loads, or eighty tons, of food, solid and liquid.

THE CHROTOGRAPH is a pencil manufactured in Germany for writing on the skin It is made in various colors, and affords legible writing, which can be easily removed without the use of water. It is designed for the use of physicians, to make memoranda upon their patients.

FAINTING AND SYNCOPE — The common practice of raising fainting persons to a sitting or upright position is often sufficient to destroy the spark of life which remains. The death of an eminent English statesman a short time ago gave opportunity to the coroner for emphasizing this fact, and of pointing out how much more reasonable and sound it is to keep such persons in the prone position while restoratives and local means are adopted to enable them, if possible, to regain consciousness.

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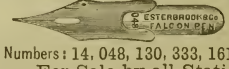

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INDEX TO VOLUME XXII.

Articles marked with (*) are illustrated.

	PAGE
A Much-needed Invention	54
Accident, A Singular	102
Ailments, Minor	185
Air-Ship, Appropriations for	121
Alcohol and Crime	128
Alcohol, The Purification of Recovered	6
Alcohol with Water, Compound of	52
Alloy, Fusible	164
Alloys, Interesting Characteristics of	57
Allspice	72
Altars, Prehistoric	68
Amalgam, Liquid	69
American Indian Jugglery	99
American Patent Medicines in Germany	15
American Railroads, Fast Time on	163
Ammonia, Use of, in Acute Alcoholism	46
Anæmia dependent on Presence of Intestinal Tapeworm	14
Anæsthetic, A New Local	48
Anæsthetic Revelation, The	127
Analysis, New Methods in	69
Aniline Industry in Germany, The	150
Animals, The Sense of	27
Animals, Ultimate Causes of Actions in	181
Antimony, The Atomic Weight of	116
Antiseptic Agents, The Chemical Incompatibility of	128
Antiseptic Surgery	125
Antiseptic Surgery, Illustrations of	141
Anti-Vaccination Theorists	128
Apothecary, An Automatic	144
Application of Static Electricity, An	86
Application of the Electrolysis of Copper to the Measurement of Electric Currents	148
Are Americans a Nervous People?	13
Art, The Healing	45
Asbestos for Filtration	70
Astronomical Phenomena (Monthly) 11, 28, 43, 59, 75, 91, 107, 124, 139, 155, 169, 184	
Atomic Weight of Oxygen, The	105
Atomic Weight of Oxygen, Redetermination of	57
Autographometer, The	6
Bacon-Shakespeare Controversy, Science in the	89
Bacon-Shakespeare Lunacy, The	26
Bacteriology, Usefulness of	15
Ballast, Electrical	6
Barnyard Waste	152
Battery, A Gelatine	37
Bee-Hive, Chemistry of the	87
Beer	24
Bell Telephone Patent, Validity of	73
Berlin Letter	42, 74, 106
Bird-Catcher, The Snow as a	74
Bird's-Nest, A Steel	20
Birds, The Flight of	38
Bismuth, Poisoning by	172
Bismuth Test	134
* Blossoms, A Device for Measuring	39
Bohemian Oats	57
Boiler-Covering, A New	70
Bone-Cutting by Electricity	158
Botany as a Recreation	3, 17, 35, 51
* Bowlder, An Immense	138
Bowlder Rocks	169
Brass, Lubricant for	6
Brass Objects, Black Coating for	54
Bread-Making, The Chemistry of	179
Breath, Wash to Perfume the	48
Bright's Disease, Some Facts concerning	94, 109
British Association at Bath, The	182
British Medical Association	172
Brown-Séquard, Experiments of	31
Bucquoy on Duodenal Ulcer	31
Building a Locomotive	150
Bumping of Fluids during Distillation, To Prevent	23
Burettes, Cleaning	23
Butter-Making, Danish	56
Butternilk as a Medicine	95
Cabling Feat, A	22
Cakes, Some Immense	180
Canned Goods	103
Canned Goods, How to Use	8
Cannon-ball Cure, The	64
Caramel Fruit	166
Carbonic-Acid Gas Industry in Germany	178
Carbon Filaments, Testing chemically	148
Carcinoma	31
Catarrh, The	61
Celery, A Great Place for	40
Celery, Cooked	160
Celery, How to Blanch	119
Celluloid	22
Cement, A Flexible	164
Cement, Salt Water for	38
Cement, Useful	23
Chamois Skin, How to Cleanse	120
Change of Air, The Stimulus of the	111
Chemical Apparatus, Simple and Cheap	21
Chemical Equivalents, A Simple Method of Illustrating	37
Chemical Notes	54
Chemical Substance Similar to Glucose	41
Chemical World, A Fury of the	132
Chemistry	132
Chemistry of a Match	135
Chemistry, The Future of	121
Cherry Stain	118
Children, The Feeding of	127
Chloride of Methylene in Cauterization	46
Chloroform as a Hæmostatic	46
Chocolate Cakes	166
Chocolate, Parisian Egg	24
Cinder in the Eye, How to Treat	31
Citric Acid, The Stolen Secret of Making	134
Cleaning Brass	120
Cleveland Meeting of the American Association, The	153
Climatology and Health-Resorts	185
Coal, A Bit of	20
Cobalt	132
Cocaine, The Antagonisms of	30
Coca Plant, The	77
Coke, Varieties of	20
Convulsion from Inguinal Hernia	32
Corn and Water	88
Cotton-seed Oil in Olive Oil, Detection of	102
Cramp in the Leg, How to Treat	96
Crematories	80
Crematory, A Garbage	15
Crocodile, A Woolly	116
Crown Prince of Prussia, The	32
Crystallization	105
Crystals, Curious Formation of	134
Current Meter, An Electrical	133
Dairy, The Chemistry of the	71
* Dandelion, The Common	65
Darwin, Agassiz Belief of	57
Dead Finish, Simple	118
Death Penalty by Electricity, The Infliction of the	95
* Debray, J. H.	145
Defoliation of Trees, The Rapid	152
Delta Metal	118
Dentifrices, Select Formulæ for	80
* Dentistry, Successful Modern	141
Dew and Frost	65
Dewdrop, The History and Mystery of a	174
Diagnosis, A False	172
Diamond, A Pyrenean	29
Diamond, An Unpolishable	116
Diffraction of Sound, The	68
Discoveries at Pompeii	36
Discovery of Hydrogen	52
Diseases of the Skin	14
* Distance to the Moon, To Ascertain the	139
Distillery-Fed Cattle	120
Do Birds build by Instinct or Reason?	98
Do Worms fall during Showers?	12, 29, 35
Doctor's Life, The Amenities of the	156
Dr. Morell Mackenzie and German Physicians	181
Doctrine of Evolution, The Acceptance of	167
Dram and Ounce, The Resemblance between	73
Driftwood Fires	89
Drug-Stores in Germany	96
Dynamite	68
Dynamite for Building	86
Dysentery	32
Ear, Injury to the Auricle	46
Ears, Care of the	111
Earthquake in Arizona	89
Eclipse Expedition to Russia	1
* Edelweiss, The	135
Edison's Phonograph, Improvement on	88
Eight-hour Day, An	83
Electric Heat Indicators	176
Electric Light for Farmers	24
Electric Lighting, Windmills for	149
Electric Motor as a Substitute for Steam-Engines	132
Electric Sunstroke	54
Electricity, Death by	121
Electricity, Levying Duty on	38
Electricity, Speed of	148
Electricity and Wine	88
Emission of Ammonia by Vegetable Mould	24
English Fast Train Record, The	178
English Sparrow, Ingenuity of	35
Engravings, To Copy	154
Erectitude, The Law of	19
Erysipelas, Cure for	15
Ether, Explosion of	38
Etheric Force	137
* Experiment, A Curious	137
Experimenting, Care in	81
Explosive, Modern	37
Eye, Photographs of the	144
Farm, A Pheasant	24
Felon, How to Abort a	64
Fermentation	138
Ferns	52
Filling Perfume Jars	120
Filter, A Quick	134
Filtration with Filters of Metallic Felt	164
Filtration, Rapid	118
* Fire Drawings	113
Fixed Standard of Length	41
Fixing Indian Ink	70
Flavors, Artificial	103
Flower, The Largest	120
Flowers by Mail, How to Send	104
Flowers for Beginners	72
Flowers, Preservation of	72
Foliage, Handsome	136
Food, The Preservation of	53
Forests and Rainfall	52
Fox, Cunning of the	35
Fracture of Index Finger, Treatment of	32
Fraudulent Advertising	105
French Academy of Sciences, The	67
Frogs: Where did they Come from?	60
Frothing in Distillation, Remedy for	38
Fruit-Canning in California	8
Fruits, The Acid of	8
Funnels, A New Support for	134
Furniture Polish	120
Gall-Stones, Use of Bicarbonate of Soda for	14
Galvanized Iron for Pipes	153
Gardens, Floating	40
Gas, A New	4
Gas Caverns	137
Gas-Making	101
Gas-Meter in England, A Patent	137
Gas, Sewer	39
Gases, Desiccation of	178
Germany, Irregular Practice in	15
Glasgow Exhibition, A Few Hours in the	129
Glass-Making	117
Glass and Porcelain Painting	69
Gleanings	8, 24, 40, 88, 104, 120, 152, 180
Glue, How to Use	6
Glycerine as an Insecticide	63
Glycerine, Internal Use of	32, 64
Glycerine Reaction, A	178
Golf-Ball's Flight, The	99
Government Meddlesomeness	36
Government Postal Telegraphs, The Question of	9
Grain-Making, The	105
Grand Magnet at Willett's Point, The	116
Gray, Professor Asa	41
Green Food in Winter	120
Greenhouse Strawberries	104
Grecks, The Ancient	68
Gruenwald on Spectra of Hydrogen, Oxygen, and Aqueous Vapor	41
Gun-Cotton, Explosion of	121
Hammers, Steam	102
Headache, Sick	63
Heliotrope Flowers in Winter	136
Hemenway Exploring Expedition	89
Highest Chimney in the United States, The	178
High Tide in Boston Harbor	137
Honey from Apple-Blossoms	104
Honey Production in California	88
Hops	135
Horses' Age, How to Tell	180
Horse Sense	57
Horse Sense, Do Horses have	8, 44
Horticultural Hints	72, 136
Horticulture, Ancient	106
Hospital, A Large	80
Hospital Telephone	158
Hot Journal, To Cool a	178
House Fly, Parasite of the	12
Household Hints	88, 120
Housekeepers, Scientific Facts for	39
House Poison	46
How a Mound was Built	162
How Birds Learn to Sing	75, 108, 140
How Celluloid is Made	164
How to Keep a Room Cool	120
How the Chinese Drill Wells	164
Human Blood, The Diagnosis of	157
* Human Food-Print, A Fossil	123
Hydraulic Cement, A Substitute for	70
Hydrocarbous with Rock-Salt in Nature	149
Hydrogen Gas, A New Source of	134
Hydrophobia, Excision for	31
Hypnotic, A New	112
Ice, Explosive	38
Iced Tomatoes	119
Imagination, Medicine for the	78
Indian, The, and Physical Pain	15
Induction, A Current	38
Industrial Memoranda	6, 22, 38, 86, 102, 150, 164, 178
Industry, A New	102
Influence of Light upon Electrical Discharges	148
Insect Stings	112
Intestinal Obstruction	31
Iodide of Mercury in Tanning	178
Iodide of Starch	162
Iodine, Tincture, to Arrest Vomiting	32
Iron Cement	118
Iron Naturally Reduced	36
Iron, Passive State of	9
Iron Rust, To Remove	6
Iron-Smelting Process, A New	38
Iron, The Action of Nitrogen on	38
Irrigation for Family Gardens, Cheap	40
James Robinson Nichols	25
* Japanese Fort, An Ancient	57
Japanese Industries	6
Keloid, Treatment of	14
Kent's Cavern: its Wonderful Story of Prehistoric Man, 114, 130	
Kerkook Petroleum Springs	149
Kerosene as a Fuel, The Use of	85
Kirchoff, Professor Gustav Robert	9
Knife for Post-Mortem Examinations	32
Knowledge, The Limitations of	49
Kuhnia as a Medicine	142
Labels and Acid	23
Laboratory Notes	23, 38, 134, 178
Laburnum Seeds, Poisoning by	15
Lamps, Care of	56
Larynx, Extirpation of	31
Laundry Suggestions	104
Lead-Poisoning from Earthenware	181
Leaden Pipes First Used	52

PAGE

Leather, Red Stain for 70
* Lecture Apparatus for Demonstrating Reflection and Refraction 133
Left-Handedness, Explanation of 31
Lemon Juice to Arrest Epistaxis 32
Lightning Flashes 132
Lightning Flashes, The Duration of 148
Lightning-Rods as a Protection 137, 176
Lightning Stroke, Effect of 14
Lights, Electrical 37
Lily of the Valley 72
Lime, Air-Slacked 56
* Liquids, The Surface Tension of 97
Liquors, Artificial Making of 167
Literary Notes 12, 30, 44, 60, 76, 92, 108, 124, 140, 155, 169, 184
Lobster, A Reasoning 100
Lobster Croquettes 119
Lobster Cutlets 119
Longest Tangent in the World, The 150
Lotion for the Skin 32

Magic Mirrors 117
Magnet, A Useful 178
* Magnetic Inductiou, An Experimeut upon 33
Magnetic Suggestions 83
Magnetization, The Electro-Motive Force of 89
Man as a Steam-Engine 77
*Manikin, The 179
Manhole Gaskets 118
Manurial Value of Nitrogen from Different Salts 152
Marmots, Geological Work of 52
Marson's Test 172
Matter at the Surface of the Earth, The Tendency of ... 147, 160
Matter made Invisible, but not Lost 82
Measuring Liquids by Drops 47
Medical Memoranda 15, 32, 48, 64, 80, 112, 128, 144, 158, 172
Medical Miscellany 63
Medicine Advertisement, A Chinese 48
Medicines, Patent, How Made 64
Megalithic Monuments of Carnac, The 160
Metal composing a Tin Can, Analysis of 137
Metallic Alloys 117
Metals, Familiar Lustre of 117
Metals, The Rare 177
Meteoric Stones, Diamonds in 52
Meteorite, A Submarine 36
Meteorite, A Supposed 84
Meteorological Phenomena (Monthly) 11, 28, 43, 59, 76, 92, 107, 123, 139, 154, 168, 183
Micro-Organism 112
Micro-Organism, Luminous 4
Military Ration, A New 48
Mind Cure, The 93
Mind Healing, A Case of 121
Monthly Summary of Medical Progress, ... 14, 31, 45, 62, 78, 93, 110, 126, 143, 156, 170, 187
Moon's Heat, The 116
Moon, Total Eclipse of 41
Mortar Prepared 178
Mosquito Bites, Remedy for 56
Motive Force of the World 6
Motor, Electric 164
Mountain Heights, Variation in 36
Mouth Wash 112
* Moving Projectiles, The Photography of 132
Mucilage, An Elastic 164
Muscle, An Anomalous 15
Mushrooms 56
Mushrooms, Edible 165
Musk, The Origin of 164
Mustard Oil as a Lubricant 86
Mutilated Chrysalides 162

Native Maiden-hair Fern for the House 72
Natural Food of Man, The 61
Natural Gas 116
Natural Gas, Ballooning with 164
Natural History Notes 35
Nature, On the Study of 34, 49
New Vegetable Perfumes, Two 162
Niagara, The Power of 178
Nickel and Cobalt, Separation of 54
Nickel and Cobalt: the Twin Metals 149
Nitrogen, Chloride of 70

Oak-Pruner, The 151
Ointment, A Useful 128
Old Age 48
Old Oil 113
Opium-Habit, The 170
* Optical Illusions 97, 140
Orange, The 23
Orchid, An Insect-Catching 8
* Orchids 151
Organ, A New Electric 150
Organic Chemistry 167
Origin of Species, The Making of the 50
Otiis 156
Ottiis, Treatment of 15
Ottar of Roses, Home-Made 104
Our Neighbor across the Way 173
Over-Heat as a Cause of Disease 63
Ozone from Pure Oxygen 54

* Panama, Prehistoric Relics at 9
Paper for Cleaning Glasses 178
Paper, Impervious and Transparent 54
Paper-Making, Ancient Materials for 102
Parchment Bearings 70
Paris Letter 18, 58, 90, 114, 147, 175
Paste for Patent Leather 164
Patent System, The 57
Paving-Stones, Iron-Brick 38
Peat 71
Pencils 150
Pendulum, Deviation of the 162
Periostitis of the Jaws 112
Peroxide of Hydrogen on a Large Scale, Manufacture of 53
Personified Plants 152
Petroleum, Origin of 89
Pharmaceutical Notes 79
Philosopher's Prescription, A 126
Phosphorus, Arsenic, and Antimony at a White Heat 20

PAGE

Phosphorus, Crystallized 132
Phosphorus, Etherial Tincture of, for Pneumonia 46
* Photographic Amateurs, Notes for 145
Photographic Art, New Discoveries in 137
Photographs, Magic 22
*Photography, Caricature 177
Photography, Dangerous 116
* Photography, Recent Feats in 58
Phylloxera, Method proposed for Destroying 24
Phylloxera, The 40
Physician, A Brave 128
Physician, Death of an Aged 16
Physiology, Some Answers in 144
Pin-hole Camera, The 101
Pipes for Furnishing Steam Heat and Power, Laying of 153
Plain Living, The Fallacy of 166
Plants, Color In 49
Platinizing Metals, A Cheap Method of 38
Platinum 53
Platinum Dishes, Cleaning 178
Pneumatic Massage 125
Pneumonia, Inverting the Patient in 14
Pneumonia, Treatment of 158
Polish, A French 164
Polypi, Removing 46
Pomology 169
Porcelain Shot 134
Positively Useful Drugs, The Percentage of 168
Potatoes à la Milanese 119
Potato-Culture, A New Method of 179
Potato Farci 119
Pot Plants, Soil for 120
Potassium in Presence of Sulphates, Estimation of 154
Practical Recipes 54, 70, 164
Practice of Medicine in Illinois, Legal Restrictions upon ... 73
Precipitation 122
Preventing Noise on Elevated Roads 150
Procuring Chemicals under Difficulties 118
Professor Proctor 167
Proposed Engineering Scheme 153
Pure Non-Arseniferous Sulphuretted Hydrogen, Method for Generating 178
Purslane Worm, The 48
* Pyrenees, Prehistoric Monuments in the 41

Quack Doctors and Medicine, Advertising of 167
Quantivalence 73
Quantivalence, An Experiment to Illustrate 134
Quantivalence of Oxygen 154
Quartz, Fine Threads of 155
Quebracho, for Burns, Frost-Bites, etc 32
Questions and Answers ..12, 29, 60, 76, 92, 108, 140, 155, 169, 184

Rabbit Pest, The 40
Radiometer (Crookes) 116
Railroad, A Persian 102
Railroad, A Siberian Pacific 22
Railroad Building, Scientific 53
Railroad in Palestine, A 102
Railroad Notes 70, 102, 150
Railroads, English and American 150
Railroads, Facts about 118
Railroads, Gauge of 102
Railway to Teheran 70
Rain-Proof Fleece for Autumn 133
Ramsey's Experiments 153
Raspberries, To Remove Old Wood from 40
Raw Meat, Value of 172
Red Color for Confectioners, A Harmless 12
Reduction of Copper in Fehling's Solution with Chloral Hydrate 16
Remarkable Engineering 22
Rendering Jewels Phosphorescent 116
Retreating Foreheads 63
Rind of Fruit Indigestible 109
River Choice, Volume of the 56
Roast of Rubbish, A 136
Rocks, The Growth and Decay of 55
Rose-Jar, The Luxury of a 120
Roses, Hedge of 136
Royal Botanical Gardens at Kew, The 146
Royal Cocoanut Tarts 166
Rubber Tubing, To Preserve 38
* Rubies, Artificial 81
Run, A Long 102
Rust, A Solvent for 164

Saccharin, A Test for 70
Saccharin Tabloids, Use of 14
Saccharin, The Use of 79
Salicylic Acid in France 127
Salts of Copper, New Reagent for 178
Sanitary Science and Domestic Architecture 13, 30
Savory Cod-Fish Patties 119
Savory Cod-Fish Balls 119
School System, Modern 41
Science in Newspapers 113
Scientific Brevities..4, 20, 36, 52, 68, 84, 100, 116, 132, 148, 162, 176
Scientific Terms, The Derivation of 1
Scientific Tests in Corn and Sorghum 40
Scotch-Oats Essence 105
Sea-Serpent, A Petrified 132
Seals, To Take Impression from 164
Sesickness, Fatal 172
Seidlitz-Powder Solution 64
Selected Recipes 8, 56, 119, 166
Sense, Do Horses have 29
Separation of Tin from Antimony, The 86
Sewer-Gas, A Test for 73
Sewer-Gas in the Production of Diphtheria and Typhoid-Fever 9, 80
Sickness, Milk 63
Sightseer's Headache, The 143
Silicon, Influence on the Properties of Steel 5
* Simple Scientific Experiments 17, 82, 139
Six Living Generations 128
Small-Pox, Use of Calomel for 46
Small Screws, To Clean 118
Snake Bite, Treatment of 186
Sneezing Formula, The Origin of the 161
Snow-Flake, A Mammoth 11
Snow from a Clear Sky 116
Soap 163
Soap-Bubbles 131

PAGE

Soapstone Paint 150
Solar Spectrum, Observations on 41
Soldering-Fluid, A New 34
Soot-Water 40
Specialism, The Tendency toward 167
Specific Gravity of Liquids, Easy Method of Finding 123
Spectre, The Dissolving 10
Spectrum Analysis, The Wonders of 129
Sphygmographs, Simple 77
Spider, An Interesting 52
Spiders' Webs 176
Sprague Motors, Use of, at Topeka, Kan 86
Stable Management 55
Starch-Sugar and Glucose 21
Stars, Number of 176
Stars, The Nearest 20
Statues, Some Queer 80
Steal, A Peculiar 102
Steamers of the World, The 6
Steam-Heating 150
Steam-Logger, A 102
Steel Implements, To Prevent Rusting 54
Stomach, An Elephant's 32
Stone, A Precious 52
Stonework, To Repair 38
Strangulated Hernia, Albuminuria in 46
Substitution of a Rabbit's Eye in place of the Human Optic 121
Sulphuric Acid 85
Sun's Atmosphere, Platinum in the 9
* Sun-Dial, How to Make a 33
Superstition, Chinese 80
Supra-Renal Capsules, The Functions of the 78
Surface Condensations of Glass 69
Swine, Feeding of 24

Table, A Useful 150
Tables, Laboratory 5
Tanning 133
Tea-Drinking, Excessive 46
Teeth as Conservators of Nerve Force 186
Teeth, Changes in the 15
Teeth, Degeneration of the Human 188
Teething: Is it a Common Cause of Disorder? 15
Telegraph-Poles, To Preserve 86
Telegraphy, Speed of 100
Telescopic Object Glass, A Large 181
Temperature, Taking and Losing the 144
*Tent of Living Vines, A 119
Tetanus Neonatorum, Treatment of 181
Thallium in Platinum 54
Thames River, The Water of the 4
Then and Now 64
The People and the Schools 122
* Thermometer, A Rotary 37
Thermometer and Barometer, Difference between 41
* Thermoscope, A Simple 54
Toads 88
Toilet Recipes of Ancient Egypt 152
To Make Varnish Adhere to Metals 118
Tomato Fritters 119
Tomato Omelets 166
Tomatos Stuffed 119
Train Mileage in America and Europe 150
Transatlantic Glances 84
Transplanting Large Trees 152
Trap-door Spiders and their Nests 115
Tree Pruner, Another 184
Tricycle, The New Steam 6
Trip, A Quick 150
Trolley-Wire Propellers 150
Trumpet, An Electric 6
Turkey, The Brush 4
Typhoid Bacilli, Detection of 144
Typhoid-Fever, Temperature in 48

Urea 109
Uterine Colic, Treatment of 14
Uterine Hemorrhage, Effects of Quinine on 14

Valve for Flasks, Improved Automatic 178
Various Diseases, The Prognosis of 96
Varnish, Black 54
Vaseline, Chemical Nature of 15
Venetian Ship-Railway, A 102
* Ventilator, A New Form of 21
Verifying Graduated Glass Tubes 134
Vladivostock, The Garrabit 150
Vinegar, Toilet 48
Vine-Pruning 88
Vines, The Time to Prune 120
* Violet, The Bird-Foot 71
Volapük 167
*Volcanic Eruption in Japan, The Recent 173

Warmth, Artificial 7
Wasps and Bees 88
Waste Silk for Steam-Pipe Covering 164
Watches, Electrical 84
Water-Clock, A Wonderful 6
Water, Turbidity of 36
Watering Plants 120
* Wax-Tree, The Japanese 87
Weeds, Imported 120
Westeru Blizzard, Recent 44
Western Cattle-Trail, The 152
What Flowers will Grow in the Shade 72
What the Cow Gives us 135
White Lead 5
Whole Wheat as an Article of Diet 7, 29
Whooping-Cough 171
Why do they? 148
Wick, An Incombustible 164
Wife, The Doctor's 47
Window Plants 120
Wine, Alcohol in 48
Wood-Carving, To Remove Paint from 164
Wood, Darkening the Natural Hue of 164
Wolcott Gibbs, Professor 116
Workshop Hints 6, 118
Wrench, The Monkey 6

Yankee *versus* Enropean Cooking 104

Zigzags in Railway Construction 165

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CONTENTS.

FAMILIAR SCIENCE.—The Derivation of Scientific Terms .. 1
The Princeton Eclipse Expedition to Russia..... 1
Botany as a Recreation 3
The Preservation of Food 3
The Brush Turkey..... 4
Scientific Brevities..... 4

PRACTICAL CHEMISTRY AND THE ARTS.—White-Lead ... 5
Laboratory Tables..... 5
The Influence of Silicon on the Properties of Steel..... 5
Purification of Recovered Alcohol..... 6
Industrial Memoranda 6
Workshop Hints..... 7

HOME, FARM, AND GARDEN.—Artificial Warmth..... 7
Cleaned Whole Wheat as an Article of Diet..... 7
The Acids of Fruits..... 8
How to use Canned Goods 8
Do Horses have Horse Sense? 8
Selected Recipes 8
Gleanings..... 8

EDITORIAL.—Prehistoric Relics at Panama 9
The Dissolving Spectre 10
A Mammoth Snow-Flake..... 10
Meteorology for November, 1887, with Review of the Autumn 11
Astronomical Phenomena for January, 1888 11
Parasites of the House-Fly 12
Do Worms fall during Showers? 12
Questions and Answers 12
Literary Notes..... 12

MEDICINE AND PHARMACY.—Are Americans a Nervous People?..... 13
Sanitary Science and Domestic Architecture 13
Monthly Summary of Medical Progress..... 14
Teething: is it a Common Cause of Disorder? 15
American Patent Medicines in Germany..... 15
Irregular Practice in Germany 15
Changes in the Teeth 15
Medical Memoranda 15
Humors..... 16

PUBLISHERS' COLUMN 16

Familiar Science.

THE DERIVATION OF SCIENTIFIC TERMS.

THE study of natural and physical laws has always been a favorite pursuit with men of all nations. One of the old Assyrian inscriptions now in the British Museum records a total eclipse of the sun, from which the date of the tablet has been accurately calculated. The construction of the Egyptian pyramids was governed, to some extent, by astronomical conditions; and as the knowledge gained from the earliest times has come down to us through many different races of men, and been recorded in numerous languages, the scientific terms at present in use tell a very interesting story of their original derivation.

The Arabs were among the earliest chemists, or rather alchemists, in Europe, and many scientific terms are derived from that language. The name "chemistry" itself is derived from the Arabic *al-kimia*. The word *kimia*, however, is primarily of Greek origin, and had the signification of black, dark, or mysterious. The Greek name for Egypt was Chemeia, from the black color of the soil. So the original meaning of *al-kimia* was the mysterious study, or the "black art." Another derivation is from the Greek *kumos*, or juice of plants, which the early students of the science extracted for medicinal or experimental purposes. "Alembic" is another Arabic word derived from the Greek. *Sal-alembroth*, a salt of mercury, which was much used by the old alchemists, is from a Chaldaic word signifying "the key of art." "Alkali" is an Arabic word from *qali*, to roast or fry in a pan, referring to the manufacture of potash from ashes.

In later times, after the revival of learning in Europe, the Latin and Greek languages were largely drawn upon to furnish names for the newly discovered substances, and to describe the laws of their action. As an illustration of mediæval superstition, we may mention the word "crucible," from the Latin *crux*, a cross, which was marked upon the lid, to prevent the evil spirits from interfering with the success of the "projection." Even this sacred symbol was unable to turn the baser metals into gold, and the faith of the alchemists must have been severely shaken at times. The word "gas" was first used by Van Helmont, a chemist of the seventeenth century, and is from the German *geist*, a ghost or spirit, or else from the verb *gäschen*, to froth or ferment. The terms "spirit of wine" and "spirit of salt" have an analogous origin.

Hydrogen is derived from the Greek, and means the "former of water:" this is a fairly good description, though it would apply equally well to oxygen. This latter element is most unfortunately named. It signifies the "acid-former," and was originally supposed to be a constituent part of every acid; but there are many acids now known which contain no oxygen at all. Hydrogen is more properly an acid-former, since this class of bodies can be defined as those which contain one or more hydrogen atoms, which are replaceable by a basic element or radical.

Ammonia obtains its name from a temple of Jupiter Ammon in Asia Minor, where the chloride (sal-ammoniac) was first manufactured from the excrement of camels. "Electricity" is from the Greek *electron*, amber, which becomes electrified upon being rubbed. "Alcohol" is from the Arabic *al-kohl*, and signified a fine black powder of antimony, which is still used in Oriental countries as a hair-dye. By some obscure process the term became applied to the liquid now known by that name. "Geology" is derived from the Greek *gea*, the earth, and "botany" from *botane*, a plant.

The origin of the names of many of the chemical elements is of great interest. Cobalt was named from the German *kobold*, supposed to be a demon of the mines who bewitched the ore, and caused the miners trouble and loss. The existence of this metal was not recognized for a long time; and when the ores failed to smelt properly, it was attributed to the machinations of the little goblins rather than to the presence of an unknown metal. Nickel ore was originally thought to be a base ore of copper, and was called derisively by the Swedish miner *koppar-nickel*, or Old Nick's copper. "Antimony" is said to be from the French *anti* and *moine;* and the story is, that the name was given to it by an abbot of an inquiring turn of mind, who administered the salts of this poisonous metal to his monks as a medicine, with very discouraging results. A more probable derivation is from the Arabic *al-uthmudun*.

Mercury, the liquid, easily flowing metal, is named after the nimble Roman god who had wings to his heels. This deity was the patron of commerce, and his name is derived from *merces*, the merchandise which he protected. "Phosphorus" is derived from the Greek *phos*, light, and is so named from its property of shining in the dark when exposed to the air. "Arsenic" is from the Greek *assenikos*, masculine, and was so called from the masculine strength attributed to this powerfully poisonous substance.

Several elements, like rubidium, thallium, indium, and others, are named from the color of the lines which compose their spectrum, chromium from the highly colored salts which it forms, bromine from its offensive odor, and glucinium from the sweetish taste of some of its salts. Many are named after mythological characters, such as thorium, vanadium, uranium, and tantalum; others after countries or regions, like columbium, gallium, and yttrium. In fact, all but a few of the more common elements are named from some characteristic property, or circumstance connected with their discovery.

As to the word "science" itself, it is, as is well known, derived from the Latin *scio*, to know; science, then, is simply *knowledge*, and a scientist is one who *knows* any subject thoroughly. Sir William Hamilton gives the following definition of "science:" "a complement of cognitions having in point of form the character of logical perfections, and in point of matter the character of real truth." The only object of scientific inquiry is to learn the truth; and the nearer we approach to the actual truths of nature, the nearer we shall be to the establishment of a pure and perfect scientific system.

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THE PRINCETON ECLIPSE EXPEDITION TO RUSSIA.

BY PROFESSOR C. A. YOUNG.

ALTHOUGH it is a weary task to recall the way that led to disappointment, I cannot well resist the kindly urging of the editors of the *Science News* that I should give its readers a brief account of our trip and our intended observations.

The principal object aimed at was, to secure an

observation of the bright lines which appear in the spectrum of the lowest region of the solar atmosphere at the moment when the last remnant of the sun's disk is covered by the obscuring moon, and to make the observation in such a way as to decide between two opposing theories. One of the theories is the older one, that all the so-called Fraunhofer lines of the solar spectrum have their origin chiefly in a comparatively thin stratum of the solar atmosphere low down and near the surface of the sun, — a stratum known as the "reversing layer." The other theory, proposed later by Mr. Lockyer, contends that only a few of the Fraunhofer lines originate in that region, while most of them are due to cooler gases and vapors at a much greater elevation. Mr. Lockyer is even cruel enough to deny altogether the existence of any "reversing layer;" and as the formerly accepted belief in its existence and importance was based largely upon an observation of my own, made at the Spanish eclipse of 1870, it was only natural that I should feel rather bound to make the best fight possible to protect its reputation. The apparatus to be used in the special observations bearing upon this point consisted of a five-inch telescope, equatorially mounted, and carrying a powerful diffraction spectroscope. In the field of view of the eyepiece was set, as a scale, a photograph of a small portion of the spectrum, — a portion containing certain lines the behavior of which at the moment of totality would be nearly if not quite conclusive as to the question in debate, as had been pointed out by Mr. Lockyer. The photographed scale would render easy the immediate and certain identification of the lines in the few seconds during which the reversal of the lines would last, just at the beginning and end of totality. I had planned to occupy the remaining two minutes of the totality in a search for new lines in the spectrum of the corona; and my attention was directed specially to certain regions where new lines might be expected, by the curious and important paper of Grünewald upon the dissociation of hydrogen, of which an advanced copy was put into my hands on reaching Pulkowa.

Professor McNeill was provided with a rather peculiar instrument for the general study of the coronal spectrum. It consisted of the great star spectroscope of the Halsted observatory, — an instrument nearly five feet long, and similar to that in use at the Greenwich observatory, but considerably larger The slit is about an inch in length, and the image of the sun and corona was to be formed upon it by a lens of only twelve inches focus, so that the observer would have before him the spectrum of a region extending more then two degrees on each side of the sun, and could study simultaneously the spectra of the upper and lower portions of the corona, and any changes that might occur during the progress of the eclipse, — with reference, of course, to the phenomena reported by Professor Hastings during the Caroline Island eclipse of 1883.

Our plan did not at first include photography, which we thought might be left to the European observers. But when my colleague, Professor Libbey, generously offered to go with us at his own charges, and look after this line of work, application was made to the Secretary of the Navy for the use of one of the two six-inch Dallmeyer photographic telescopes which had been provided for the Naval Observatory parties on occasion of the eclipse of 1878; and our request was granted. An equatorial stand with clockwork was built in the college machine-shop, and the government telescope and various cameras of different abilities were mounted upon it for the purpose of securing a large number of different pictures of the corona itself and the region around the sun. Professor W. H. Fickering of Cambridge also sent us a six-inch telescope, to be used without mounting or clockwork, for the purpose of making a special set of pictures to be compared with those which were expected to be made in the same way and with a similar instrument by Professor Todd in Japan. (But that observer was no more fortunate than we).

Our instruments were packed in six substantial boxes, and sent off by Wells, Fargo, & Co.'s express on June 11; and we never saw them again until we found them safe and in good order at our station, awaiting our arrival. We ourselves sailed on "The Etruria" on June 25, — seven of us: Professor Libbey, his wife and two of her young friends, Professor McNeill, Mr. Fisher (our university machinist), and myself. A delightful seven days' voyage brought us to Liverpool, where we parted temporarily, agreeing to rendezvous in Berlin on the 1st of August. Professor McNeill remained with me; and we took together a roundabout route through London, Paris, Strassburg, Munich, Vienna, and Prague, visiting the observatories and the astronomers in these different cities.

Space does not permit any detailed account of what we saw and learned, but it is pleasant to recall the kindly courtesy and hearty welcomes we everywhere received. Specially interesting were our visits at Greenwich, at Meudon (near Paris), at Vienna, and to the queer old observatory at Prague, where are still standing some of the ancient quadrants with which Tycho and Kepler used to make their observations. After our party came together at Berlin, we also visited the old observatory there, and the wonderful new astro-physical establishment at Potsdam.

We left Berlin, all seven together, in the highest health and spirits, on Aug. 5, and the next evening were in St. Petersburg. Our passage of the Russian frontier was made without the slightest difficulty; and we were treated by all the officials of the custom-house and the railway train with marked courtesy, which we afterwards learned was due, in part at least, to orders received from headquarters in consequence of a letter which Baron Struve (the Russian Minister to Washington, and brother of the astronomer) had written announcing the coming of our party. Our instruments were admitted duty-free and without detention, and every thing possible was done to assist us. Dr. Struve of Pulkowa arranged every thing relating to stations and transportation of instruments in such a way that all care and anxiety on our part was entirely precluded.

We were met at the station in St. Petersburg by his son, Dr. H. Struve; and during the week that followed we were continually the recipients of his kind attentions. Of course, we saw and enjoyed all the interesting sights of the Northern capital; but to me, at least, the most enjoyable of all the days were those I spent at Pulkowa, in the home and family of the great astronomer. It was a real wrench to say farewell to some of our kind-hearted new-found friends of only a week's acquaintance. Of course, the city was full of eclipse people, and they all went to Pulkowa. One day at lunch there were fourteen astronomers at table (not counting three ladies), speaking six different languages.

Our party left St. Petersburg on Monday evening, Aug. 15, having Struve himself with us; and the next day we were at our station, having dropped him on the way at Torjok. The place he had selected for us was at a country seat about eight miles from Rschew or Rjeff, a city of some twenty thousand inhabitants on the upper Volga, about a hundred and fifty miles west and a little north of Moscow. The estate belongs to two wealthy young married ladies, who no longer make their home there, and had put the place at Struve's disposal for our use. To these ladies, Mme. Olga Nieskovsky of Warsaw, and Mme. Vera Tchernicheff of Torjok, and to their agent, M. Nieskovsky of Rschew, we owe more than can be well expressed; and, if possible, still more to Capt. Witkovski of the Russian Engineer Corps, who had been sent by his department to our station to determine its geographical position, to make certain time-observations we had not specially provided for, and with special orders to do all in his power to aid us and make things agreeable; orders which he carried out with such heartiness and tact, that he will always be remembered by every one of the party with something warmer than mere regard. Our quarters were in a huge brick mansion, some of the rooms in which were very large and handsomely furnished, while others were small and comparatively plain. The steward and the servants who had charge of the house took excellent care of us, and, excepting as to weather, we have the pleasantest memories of our five days' entertainment there. We had had the finest of weather all the way from New York until we reached St. Petersburg, when it began to be showery and uncertain. It was not encouraging during our journey from St. Petersburg to the station; and there, bad became worse.

On Tuesday P.M. and Wednesday we set up our instruments in the intervals between drizzling showers; on Thursday morning it was clear for a time, but in the afternoon it rained hard. In the evening it cleared up again about ten o'clock for an hour or two, and our hopes were raised to the highest pitch of expectation. The ladies went through their drill with the photographic apparatus they were to operate, until they had it perfectly; and we were exultantly making our last preparations when the captain, who had been trying to observe some stars, came in and announced that it had clouded again, and sent us to bed disconsolate.

In the morning we were astir at four o'clock, for the sun rises early there in August, and the first contact was to occur at half-past five. It was a gray, dull, misty morning, raining a little, but not so heavily as to preclude all hope of clearing. We put every thing in readiness, and waited for a glimpse of sunlight — which never came: it only rained a little faster. The time of first contact passed, and that of totality drew near. The obscuration was to last from 6.32 to 6.34. Gradually the morning brightness gave way to gloom, which grew denser about 6 30, but not with any such suddenness as made it possible to fix the moment of beginning with any certainty. On the other hand, when the totality ended, there was a sudden — in fact, almost instantaneous — lighting up. The gloom was by no means so intense as that at either of the three other total eclipses I have seen. I could easily read my watch-face, and I noticed that the sash-bars in the window of a building some six hundred feet away continued visible through it all. A few pigeons and some cattle and poultry that were within the range of observation appeared to be rather puzzled and annoyed by the sudden twilight; and a little group of the peasants of the estate, who stood near us, began to cross themselves and say their prayers when the darkness was greatest. Some thirty minutes later the half obscured disk of the sun showed itself for a few moments, through drifting clouds, and then the rain began again. At half-past seven every thing was over, and we sat down defeated and heavy-hearted. We immediately went to work to dismount and repack our instruments, and by night the task was nearly done. The next day at noon we started them off, intrusting them to the care of Capt. Witkovsky, who kindly looked after their shipment for us; and in the afternoon

we took our leave of him, and began our homeward journey, *via* Moscow, Warsaw, and Berlin.

Space will not permit the recital here of our pleasant experiences at Manchester in attendance upon the meeting of the British Association, nor of my visit to Lord Rosse and his great reflectors at Birr Castle. It must suffice to say that we all reached home safely and well, and that our instruments followed in due time, — a little slowly, but without accident or damage.

It would be unpardonable to omit a mention of the generous liberality which provided the necessary funds. The money came mainly from the same friends who have already done so much for the scientific departments of Princeton College. But there were other contributors also; in fact, the expedition really originated in a gentleman's spontaneous offer of two hundred and fifty dollars towards meeting the expenses of the undertaking, if it should be found practicable to organize a party.

[Original in *Popular Science News.*]

BOTANY AS A RECREATION.

BY FREDERICK LEROY SARGENT.

I.

"Botany is by many regarded as a dry science. Yet without it, one may admire flowers and trees as one may admire a great man or a beautiful woman whom one meets in a crowd; but it is as a stranger. The botanist, on the contrary, — nay, I will not say the botanist, but one with even a slight knowledge of that beautiful science, — when he goes out into the woods or into one of those fairy forests which we call fields, finds himself welcomed by a glad company of friends, every one with something interesting to tell." — Sir John Lubbock, *Pleasures of Life.*

At the close of his charming book on ferns, Mr. John Robinson makes the following plea for hobbies: "There is a large class of persons who are so fortunate (or unfortunate, according as they use or abuse the privilege) as to have nothing to do; or, to speak more exactly, have to do only what they choose. This class must have a hobby, or they will *rust* out. Another class are engrossed by incessant professional work, which leaves them every day cross and tired. These should have some outside hobby, or they will become one-sided and crabbed, and *wear* out. Dr Jacob Bigelow of Boston, being a hard and earnest worker in his profession, determined, for his own good, to select some sensible form of recreation, and chose the study of botany, as necessitating long walks and refreshing thoughts. The result was the publication, in 1814, of his *Florula Bostoniensis*, which, enlarged and improved in later editions, became the standard reference-book for all botanists in that portion of the country, and for more than a third of a century held its ground undisputed, until the larger and more modern works of Dr. Gray superseded it. Dr. Bigelow published other works and, although these are not now in use as text-books, they still hold an important place among books of reference. All this came from a hobby. Without an object, we walk aimlessly, we read aimlessly, we think aimlessly. Without a hobby, no great man would be great." It is to such as feel a need for some profitable means of recreation, that we would address ourselves, and try to show how far botanical studies are calculated to meet their wants.

The study of botany becomes truly a recreation, and awakens within us a sustained and absorbing interest, largely in proportion as we actually examine plants, and ponder over them, and not merely read about them. The true value of botanical writings, at least for the beginner, is their importance in directing attention to what there is to be seen; telling how to observe, and what has been thought about these things by experienced botanists. The present article aims to be of service mainly in the first of these capacities; on the second count, it can be directly of use only so far as a few practical hints may prove helpful; while in all these points it may be indirectly of value through references to books which are of especial aid to American students.

A much too restricted idea of the range of botany is widely held, even by educated people. To know merely the names of the different kinds of plants is commonly considered to be about all there is of the subject. This is unfortunate, as it leaves out of view some of the most valuable departments of the science. A definition which is well calculated to correct this erroneous impression, and put the matter in its true light, is the following, which Professor Goodale gives to his classes: "Botany is the science whose business it is to deal with all the reasonable questions that may be asked about plants."

Now, until one has studied the subject, it is scarcely possible to realize what a vast number of questions botanists have already answered, and what a still vaster number remain to be answered, and are to-day engaging the attention of botanical students all over the world. The class of questions to which mankind first gave earnest attention were such as relate to those properties of plants that render them useful or dangerous. To-day such considerations form that comparatively small part of the subject which we call economic botany. Questions involved in the naming of plants, and the orderly arrangement of the myriads of different kinds according to their degrees of resemblance, belong to the department of systematic botany, and have occupied, so far, the principal attention of botanical workers. Within recent years, along with the growth of chemical knowledge and the perfection of the microscope, there has been developed a steadily increasing interest in all questions pertaining to the life of plants, their structure, and the significance of the forms assumed by their various organs. Physiological botany is the department which deals with these matters. Other departments are, geographical botany, dealing with the distribution of plants over the earth; and fossil botany, which is concerned with the plants of past geologic ages: and still other classes of questions could be referred to, but enough has been said to show that botany is much more than the "plant analysis" of the schools, and that there is in it a variety of interest sufficient to satisfy very diverse tastes.

For our present purpose, it will be enough to consider only the two principal departments, — namely, systematic and physiological botany, — since these offer the best opportunities for practical work on the part of a beginner.

SYSTEMATIC BOTANY.

Perhaps the most obvious of the pleasures which the study of plant-kinds is calculated to afford, is the satisfaction of knowing at sight the plants we meet, or, at least, of having it in our power to find out what names they bear. Apropos of one of her trips to the country, George Eliot says: "I never before longed so much to know the names of things as during this visit to Ilfracombe. The desire is part of a tendency that is now constantly growing in me to escape from all vagueness and inaccuracy, into the delight of distinct, vivid ideas. The mere fact of naming an object, tends to give definiteness to our conception of it. We have, then, a sign which at once calls up in our minds, and marks out for us that particular object from all others."

An enthusiastic searcher after plants gets much the same sort of pleasure in his excursions into field and wood as does the hunter or fisherman; and in the capture of a rare flower, often as great prowess is displayed. Since much of our game is becoming scarce, almost to extinction, it is next to impossible for many of us to gratify the hunting instinct with either rod or gun; and as the humane spirit develops among us, there is less desire to indulge in sport which involves the infliction of pain. With us the love of hunting is so largely a love of outdoors, it seems as if botanizing were well calculated to afford a sufficient motive.

We must not, however, forget the pleasures of indoor botany. Having collected a plant is but a first step toward the enjoyment which comes from the study of its hidden beauties.

From the outset of a student's introduction to systematic botany, he encounters technical terms which must be learned before he can understand the descriptions in the books that he will have to use. We often hear this circumstance apologized for by writers who wish to present the study in an attractive light. Such writers seem to forget that technicalities are a necessity wherever we are called upon to talk with definiteness upon any subject outside of every-day conversation. We do not hear apologies offered for the technicalities of music, or even of a game of cards; but when it comes to the study of plants, it appears to many that there is something almost sad about their having to use so many words that are new to them.

It may be admitted that botanical terms, when forced upon one to be learned by rote, may be very tedious; and when, as in certain schools, such work is made to do duty for "botany," it is no wonder that pupils should vote the study an unmitigated bore. But there is a way in which one may obtain the same kind of pleasure in learning these technical terms as in learning the names of plants.

We will suppose that the student is provided with such a book as Gray's *Lessons in Botany*, which contains all the technical terms that a beginner needs to know, and explains them fully. It is not enough to merely read the book, and learn the definitions; for this is not only very dry work, but it fails to give a clear understanding of the practical application. What is needed is, for the student to search the fields and woods, or garden and greenhouse, for actual examples of what is mentioned in the book. Suppose he is on the subject of leaves: let him collect a number of different kinds, and try to describe each with regard to its venation, general outline, base, apex, margin, upper and lower surface, and other peculiarities that may suggest themselves. If at loss for a term, the book may be consulted; and if no term is provided for the peculiarity in question, "plain English" may be made to answer the purpose. Even a poor memory is forced to retain what is often repeated; and the student will find that before long he can take any leaf that comes to hand, and describe it accurately and tersely. When, in this manner, a student has become familiar with the forms of roots, stems, leaves, inflorescence, floral organs, and fruit, he is well prepared to learn the use of those books which describe the kinds of plants, and give us their names.

THE PRESERVATION OF FOOD.

BY S. P. SHARPLES, S.B.

A few years ago I was called upon, in a case before the United States courts, to investigate the subject of canned sweet-corn. Although this was only about fifteen years ago, the whole subject was a comparatively new one. Dr. Jeffries Wyman had published his researches on spontaneous generation: but even he, with all his skill, did not succeed in properly preparing his solutions; and from this reason many of his experiments were failures.

Tyndall had not made his celebrated experiments on dust. The general opinion seemed to be, that the only point necessary to be observed was to exclude the air from the article to be preserved; and the readiest way of doing this was to fill the can with steam. At this time there was some controversy as to whether it was best to punch a hole in the head of the can before heating, or after; in either case it was closed as soon as the steam issued freely, and the can was allowed to cool. If the ends of the can became concave, it was evidence that it had been properly exhausted of air, and the goods would keep. If, on the contrary, the heads swelled out, it was evidence that the article was not keeping, or, as the manufacturer thought, the can had not been properly vented, and too much air was left in it. At the time of this trial one of the counsel made a number of experiments that seemed to show conclusively that the air had nothing to do with the matter; but these were not published, and therefore the credit of the investigation belongs to Professor Tyndall.

During the progress of the trial frequent reference was made to one Appert, a Frenchman who lived in the early part of this century. But if I recollect aright, the only definite thing we found in regard to him was his English patent. We had an idea that he published a book upon the subject, but this book was not to be found in any of the libraries to which we had access.

Within a year or two I have been able to procure a copy of this work. It is an octavo volume of xxxxviij + 176 pages. The copy that I have is the third edition, and the forty-eight pages of preface are devoted to defending the process of the author against the attacks that were made upon it, and the false statements made in regard to the process. The title of the work is as follows: "Le Livre de tous les Ménages, ou l'Art de Conserver, pendant Plusieurs Années, toutes les Substances, Animales et Végétales, par M. Appert, propriétaire à Massy (Seine et Ouise), ancien confiseur et distillateur, élève de la bouche de la Maison Ducal de Christian IV. Paris, 1813."

This may be translated as follows: "The Book of all Housekeeping, or the Art of Preserving, during Many Years, all Substances, Animal and Vegetable, by M. Appert, proprietor at Massy, formerly confectioner and distiller, assistant to the cook in the Ducal Mansion of Christian IV."

Briefly, his method consisted in placing the articles to be preserved in wide-mouthed glass bottles, which he says he prefers to those of metal, since they do not acquire a bad taste. They were then carefully corked — and on this point he lays special stress — and plunged into boiling water, in which he keeps them from a half-hour to two hours according to the articles; articles that are liquid requiring less time than those which are solid. He tried his hand at preserviug every thing iu the kitchen. Among the various articles experimented upon were milk, which he condensed to one-fourth, and then placed in bottles, and found it good six months afterwards; thus anticipating Gail Borden nearly fifty years. He also preserved tea and coffee. The latter has within a year past been made a commercial success by a process not varying essentially from Appert's, and coffee can now be procured in the market which, in the words of Appert, requires only one coffeespoonful of the extract to make a cup of excellent coffee, having all the flavor of the original. Travellers are no longer at the mercy of the railroad restaurants in this matter: a six-ounce bottle will contain enough of the extract to make twenty-five good cups of coffee. It would have probably surprised even Appert, with his sanguine expectations in regard to his process, had he been told that in 1882 millions of cans of meat would have been preserved in Chicago for the use of the British troops in the Soudan by substantially his process. In his day Chicago was a wilderness, and the Soudan had been inaccessible to Europeans for centuries.

This invention of Appert's now gives employmeut to thousands of people, and enables us to have fresh salmon from the Columbia River on our tables. It has caused scurvy to become an almost unknown disease, enabling those on shipboard to be supplied with fresh vegetables at all times of the year. Of three articles alone, over a hundred million cans are preserved every year; these are tomatoes, corn, and peaches.

Civilization in the West may be traced by the empty cans left in its tracks. I have found them on the tops of the highest of the Rocky Mountains, serving there as a card-receiver. Miners cover their cabins with them, and use them as cooking utensils and water vessels. The tourist goes to the mountains and enjoys his fresh vegetables raised on the "proprietor's own farm;" but such vegetables were raised the year before in New Jersey or Maine.

One of the most severe tests to which these goods were ever subjected was the following: The ship "Fury" was wrecked in 1825 in Prince Regent's Inlet, and her stores were left on the beach. Eight years afterwards they were found by Sir John Ross, who wrote to Mr. Gamble, who preserved them, in a state of perfect preservation, although they had been exposed to temperatures of 92° below and 80° above zero. After a further interval of sixteen years they were found still in a state of good preservation. Cans opened forty-four years after they were prepared were found to be sound and in good order.

13 BROAD STREET, BOSTON, *Dec.* 1, 1887.

THE BRUSH TURKEY.

"ALL birds hatch their eggs." Zoölogy knows very few exceptions to this rule; and although old works on natural history state that the sun relieves the ostrich of this duty, it is now known that she attends to the work most conscientiously. Only the cuckoo succeeds in shirking this business entirely, leaving her little ones to the mercy of kind-hearted little siugers. Besides this bird, we may mention the brush turkey as one which does not hatch its eggs; but it is more conscientious about the matter than the cuckoo. The brush turkey (*Talegallus lathami*) is a powerful bird, attaining a size of about thirty-one inches, and can be recognized by its powerful build, rather long neck, large head, sharp, bent beak, strong feet, aud short, rounded wings. The scarlet of the featherless neck, aud the yellow pouch dependent therefrom, stand out in decided contrast to the brown plumage. The home of the brush turkey is in the thick forests of Australia. At mating time (in the spring) the male develops a surprising amount of activity and industry. He picks out a sheltered spot for a nest, and then goes to work to build a mound. With his stroug feet he throws a quantity of leaves, fibres of wood, small twigs, dry grass, etc., into a heap behind him, and this forms the centre of a large circle, the periphery of which soon appears perfectly clean, and a mound about a yard and a half high is built. While other birds go at once to their newly prepared homes, and begin to lay their eggs, the brush turkey pursues an entirely different course. The wise creature waits several weeks, until the fermentation and decomposition of the vegetable matter in the heap has generated a heat of about 104° F., the temperature required for either natural or artificial hatching of eggs. It is wonderful to see with what certainty the birds determine upon the proper time. The male often mounts the nest to examine it, scrapes off a little here and a little there, and then covers the places over again carefully. When he finds that the temperature of the mass is what it should be, he digs numerous holes about the axis of the mound, and in each one of these holes the female drops an egg with the blunt end up. After the male has closed these holes, both birds go away; the male only returning from time to time to regulate the heat, covering the eggs more or less, according to the moisture and temperature of the atmosphere. After about three weeks the young are hatched. They are entirely covered with feathers, their wings are well developed, and they seem as strong as our domestic chickens. The whole process reminds one of the development of the butterfly, which is able to fly soon after leaving the chrysalis. After about twelve hours the young brush turkeys appear merry and active, wandering about with their parents; but in the afternoon they are buried in the nest again by their careful father. On the third day they are able to fly, and after that are perfectly independent. Their process of hatching has been carried out by brush turkeys in captivity, as, for instance, in the Berlin Zoölogical Garden, when they formed the centre of attraction for friends and students of zoölogy. — *Deutsche Illustrirte Zeitung.*

SCIENTIFIC BREVITIES.

THE WATER OF THE THAMES RIVER makes very good ink; and letters concerniug that fact, and the nuisance which is caused by the condition which makes it possible, have been written to the London daily papers, in which it was used as a medium to impress indignation upon paper.

A NEW GAS. — The discovery of a new gas is reported in Germany by Dr. Theodore Curtius, who has succeeded in preparing the long-sought hydride of nitrogeu, amidogen, diamide, or hydrazine, as it is variously called. This remarkable body, which has hitherto baffled all attempts at isolation, is now shown to be a gas perfectly stable up to a very high temperature, of a peculiar odor, — differing from that of ammonia, — exceedingly soluble in water, and of basic properties. In composition it is nearly identical with ammonia, both being compounds of nitrogen and hydrogen.

LUMINOUS MICRO-ORGANISMS. — Dr. C. B. Tilanus gives, in a Dutch scientific journal, the results of some recent researches on luminous micro-organisms. He prepared a flat culture from luminous mucus obtained from the exterior of fish, with fish-broth peptone jelly, to which two per cent of common salt had been added as a medium. This became speckled with numerous cultures, some of the jelly, but not the greater part, becoming liquefied. Iu the dark this flat culture emitted a distinct light, and appeared as if strewn with stars; from this a stripe culture was prepared: and, after successive preparations had been made, Dr. Tilauus believed he had obtained a pure culture of the phosphorescent organisms.

FLUORIDE OF NITROGEN. — The supposed compound was formed by passing an electric current from seven ferric chloride batteries through a concentrated solution of ammonium fluoride. After the lapse of a short time, several drops, of oily consistence, were observed attached to the negative plate. On becoming connected with the positive, a thin gold wire, these drops exploded with violence. The compound is highly unstable, being at once decomposed in contact with glass, silica, or organic matter, thus rendering the analysis of the same one of considerable risk. Its explosive violence is even greater than the chloride of nitrogen.

Practical Chemistry and the Arts.

WHITE-LEAD.

This very important salt of lead, which is so extensively used as a paint, is, chemically considered, a basic carbonate. Thus, to the regular neutral carbonate $PbO\,CO_2$, we may add additional atoms of plumbic oxide, forming a compound with the general symbol $(PbO)_xCO_2$; and the covering power (and consequently the value of the product) seems to depend upon the number of additional molecules of oxide that we can attach to a molecule of carbonic dioxide.

Although numerous processes for the scientific manufacture of white-lead have been invented, none of them are quite as satisfactory as the old-fashioned "Dutch" method, and probably more than nine-tenths of all the lead in the market is made by that process. It was really introduced into Europe by the Saracens, who carried on the manufacture in Southern Spain, whence the Dutch brought it to Holland in the sixteenth century. In this process, the lead, which is first cast into perforated disks called "buckles," is placed in earthen pots in the bottom of which is a little vinegar. The pots are then covered, and buried in a mass of fermenting stable manure, to which spent tan is sometimes added. Owing to the heat of the fermenting manure, the vinegar is evaporated, and the acid vapors combine with the metal to form the basic acetate of lead, which in turn is converted into the basic carbonate by the action of the carbonic acid, which is also a product of the fermentation. In a few weeks the pile is opened, the pots removed, and the white-lead separated from the pieces of unaltered metal which remain. It is then usually ground in oil, and comes into the market in the familiar form of a pasty mass.

Attempts have been made to substitute, in the place of the unreliable manure-heap, a closed box or chamber in which the lead is placed, and into which vapors of acetic acid and carbonic-acid gas are passed. It is also made in the wet way by dissolving litharge (oxide of lead) in acetic acid, thus obtaining a solution of basic acetate of lead, and then passing a current of carbonic-acid gas through the solution, which precipitates part of the lead as a basic carbonate, leaving a neutral acetate in solution; more litharge is then added to the solution of neutral acetate, and the process repeated.

For some unknown reason, none of these processes give quite as good a product as the original Dutch method; and it seems to be one of those rare cases where "the rule of thumb" is more successful than a more rational and scientific method. Possibly one reason is, the difficulty of obtaining a supply of pure carbonic-acid gas. It is usually obtained from the combustion of coke or coal, and is likely to contain traces of sulphur compounds, which discolor the white-lead by uniting with it to form the black sulphide. At Brohl, in Germany, there is a natural supply of the gas from the earth, which is used for this purpose.

Silver, which is usually a very desirable metal, is a source of annoyance to the manufacturers of white-lead. Lead frequently contains a small percentage of the precious metal; and, if the quantity is appreciable, it spoils the color of the finished product, owing, probably, to the well-known blackening effect of light upon silver salts. There are numerous other precautions which must be taken to obtain a first-class article of white-lead, and the necessary knowledge can only be gained by long experience.

The manufacture of white-lead is properly considered as a "death-dealing trade," more especially to the workmen who have charge of the grinding of the dry powder. The fine lead-dust is absorbed into the system, and produces a train of very characteristic symptoms due to lead-poisoning. In France the paternal government of that country requires manufacturers of white-lead to pension their employés after a certain age, considering that their health will be so impaired that they will be unable to earn their living. Once, while visiting a manufactory, we noticed that some facetious person had inscribed upon the grinding-machine the rather startling legend, "death's friend." It is said, however, that, with due care, no cases of poisoning need occur, and that the evil effects are largely due to the carelessness of the workmen, who neglect the necessary precautions of cleanliness, etc. The physician in charge of a large city hospital where cases of lead-poisoning are frequently treated, informs us, that, after being once cured, the patients return to their old trade, and are soon back in the hospital suffering from the same disease, — a curious example of the force of habit.

The liability of white-lead to be discolored by sulphuretted hydrogen renders it an unsuitable paint for localities where the air is likely to be contaminated by sulphur compounds. Some years ago the paint on some buildings near the mouth of a sewer near this city was turned nearly black by the gases arising from it. This discoloration was intended to be brought forward in a lawsuit as evidence of the nuisance created by certain manufactories which were drained by the sewer. Before the case came to trial, however, the ozone in the sea-air had oxidized the black sulphide to the white sulphate, and thus the evidence was destroyed by natural causes. In the case of old paintings where the white tones have become discolored, it has been recommended to apply a solution of peroxide of hydrogen, which will have a similar effect, and thus restore the brilliancy of the picture.

LABORATORY TABLES.

Though it has its drawbacks, there can be little doubt that the best material for a laboratory table-top is wood. Other materials may be better for special purposes, but for general use wood is best; and among woods teak is to be preferred. The wood ought never to be varnished or painted, as the action of alkalies and strong acids on the preparations employed renders the table unsightly. The now common custom of saturating the wood with melted paraffine is not open to the same objection, and has, indeed, many advantages. The paraffine renders the wood impervious to water, and, on account of its chemical indifference, it prevents the table being seriously attacked by sulphuric acid or caustic soda, which will sometimes be spilled even in the best-regulated laboratories. Probably the chief objection to paraffine is, that it melts and adheres to any warm vessel or apparatus that may chance to come in contact with it. In this way a new source of error is introduced into analyses, as the slight coating of paraffine on a capsule or crucible lid, being invisible, may be forgotten to be removed by ignition or otherwise before weighing. Of course, it is easy to say, "Never lay any vessel you intend to weigh on the table;" but a possible source of error is present, all the same. My own view of the matter is, that for qualitative and general work it is well to have the tables paraffined, while for quantitative and finer work it is better to have the surface clean.

Slate is objectionable as a material for tables, firstly, because of its antipathy to glass vessels; secondly, because it is not readily pierced or cut; and thirdly, because it is cold to the touch and cold to look at. Yet it is the best kind of surface on which to place the combustion-furnace, air-bath, and similar apparatus. In like manner, although lead is not to be commended for general use, it is a good plan to have one table covered with it, and so arranged that any liquid falling thereon may collect at one end, and so be run off into the waste. All distillations should be conducted on this table, which is not only a convenient arrangement for getting rid of the water used in condensing, but is also a security against danger when working with inflammatory liquids.

The attempt to convert each working bench into a sort of complete laboratory seems to be a mistake, however heretical this view may appear to some. To have tank-water, distilled water, steam, gas, draught, and sink "laid on" at each bench, produces an unnecessary and expensive complication of pipes; and the more pipes and stopcocks, the more plumbers and repairs. Simplicity is a great principle in the arrangement of laboratories, as in most other matters. All materials and apparatus required by each worker should be within easy reach, but not necessarily at his own particular table, which should, indeed, only be supplied with those requisites the absence of which would produce positive inconvenience. — D. B. Scott, *in Chemist and Druggist*.

THE INFLUENCE OF SILICON ON THE PROPERTIES OF STEEL.

The following are the general conclusions arrived at by a committee of the British Association from a series of experiments conducted by them. On adding silicon, in the form of silicon pig, to the purest Bessemer iron, the following results are obtained: —

The metal is quiet in the mould when even a few hundredths per cent of silicon is added. The metal is originally red-short, especially at a dull red heat, though it works well at a welding temperature; the red-shortness is increased by silicon. In all cases examined, the metal was tough cold and welded well, silicon having little or no influence. Silicon increases the elastic limit and tensile strength, but diminishes the elongation and the contraction of area, a few hundredths per cent having a remarkable influence in this respect. The appearance on fracture by tensile force is

changed from finely silky to crystalline, while the fracture produced by a blow gradually becomes more like that of tool steel as silicon increases. The hardness increases with the increase of silicon, but appears to be closely connected with the tenacity. With four-tenths per cent of silicon and two-tenths per cent of carbon, a steel was obtained difficult to work at high temperatures, but tough when cold, capable of being hardened in water, and giving a cutting edge which successfully resisted considerable hard usage. In some cases silicon was present in the oxidized condition; the effect is then very different, and the mechanical properties of the metal more nearly resemble those of the original Bessemer iron.

In the second series of experiments various proportions of silicon have been added to ingot metal, containing manganese and carbon, as ordinarily met with in commerce. The results are not yet quite ready for publication; but they show that manganese greatly modifies the effect of silicon in producing red-shortness, and hence enables the metal to be readily rolled and otherwise worked, even in presence of several tenths per cent of silicon. The low extension, however, though not nearly so marked as before, is still observed despite the presence of manganese; and hence, for the majority of the applications of mild steel, silicon does not appear to be advantageous. — *Chemical News.*

PURIFICATION OF RECOVERED ALCOHOL.

MR. R. D. PEYTON, in a paper read before the Kentucky Pharmaceutical Association, gives the following methods, which have proved successful in his experience : —

Recovered alcohol	1 gallon.
Bichromate potash	¼ ounce.
Dilute sulphuric acid . . .	2 fluid drachms.

Let it stand three days (with occasional agitation), and filter; then add lime, half an ounce, and after twenty-four hours filter through animal charcoal, and distil. Or the following: —

Recovered alcohol	1 gallon.
Permanganate potash	40 grains.

Let it stand five days, and filter; then add lime, half an ounce; allow it to stand twenty-four hours, filter through animal charcoal, and distil.

INDUSTRIAL MEMORANDA.

A WONDERFUL WATER-CLOCK. — Haroun-al-Raschid, the principal hero of the *Arabian Nights Entertainments*, sent to Charlemagne, in the eighth century, a water-clock in the dial of which a door opened at each hour; and when at noon the twelve doors were thrown open, as many knights on horseback issued forth, paraded round the dial, and, then returning, shut themselves in again.

ELECTRICAL BALLAST. — It is well known that some of the large yachts have a great many tons of lead stowed away in their keels. *The Engineer* suggests that this lead could be utilized in the shape of accumulators that could thus be made to carry several horse-power, which, with the intervention of a motor, could be utilized in working the windlass, hauling in the main sheet, etc., and furnishing light as well. As is remarked, it would be rather a novelty to have the ballast weighing the anchor or hauling at the ropes; but stranger things than that have been done before.

THE NEW STEAM TRICYCLE. — *La Nature* recently described and illustrated a steam tricycle designed by MM. Roger de Montais and L'Héritier. It states that the machine will go nine to eleven miles per hour with one person, and eight to ten with two. In front is a small petroleum-heated boiler, and a petroleum reservoir is placed under the seat, holding ten liters, and said to be enough to last ten hours. A water reservoir, which holds thirty-four liters, is mounted, carrying a supply for two and a half hours.

THE AUTOGRAPHOMETER. — M. Floran de Villepigne has devised an instrument, the autographometer, which records automatically the topography and difference of level of all places over which it passes It is carried about on a light vehicle; and those who wish to use it have nothing to do but to drag it, or have it dragged, over the ground of which they desire to obtain a plan.

AN ELECTRIC TRUMPET. — An electric trumpet has been recently devised by M. Zigang. It consists, says the London *Electrical Review*, of a short brass tube mounted on wood, and containing an electro-magnet whose ends face a vibrating plate, on which is fixed a small piece of soft iron. Against the plate-armature rests a regulating screw with platinum point, which serves for automatic interruption, by vibration of the armature. With two Leclanché elements a musical sound is obtained, which may be varied in pitch, intensity, and timbre by means of the screw. This instrument may be usefully employed in signalling on ships, railways, tramways, etc.; it may also serve as a receiver for signals of the Morse type.

THE STEAMERS OF THE WORLD. — Recent statistics show that the number of steamers existing in the world in 1886 was estimated at 9,969, of an aggregate burden of 10,531,813 tons. In the previous year the number was stated at 9,642, of an aggregate burden of 10,291,241 tons. The world's steam shipping in 1886 was thus distributed: Iron steamers, 8,198, of an aggregate burden of 8,911,406 tons; steel steamers, 770, of an aggregate burden of 32,820; and wooden steamers, 822, of an aggregate burden of 380,655 tons. Of the steamers afloat in 1885, 5,792 were owned by the United Kingdom and its colonies, their aggregate burden being 6,595,871 tons.

THE MOTIVE-FORCE OF THE WORLD. — The Bureau of Statistics in Berlin has recently issued some interesting information in connection with this subject. It appears that four-fifths of the engines now working in the world have been constructed during the last twenty-five years. France owns 49,590 stationary or portable boilers, 7,000 locomotives, and 1,850 boats' boilers; Germany has 59,000 boilers, 10,000 locomotives, and 1,700 ships' boilers; Austria, 12,000 boilers and 2,800 locomotives. The force equivalent to the working steam-engines represents, in the United States, 7,500,000-horse power; in England, 7,000,000-horse power; in Germany, 4,500,000; in France, 3,000,000; and in Austria, 1,500,000. In these figures the motive-power of the locomotives is not included, whose number in all the world amounts to 105,000, representing a total of 3,000,000-horse power. Adding this amount to the other powers, we obtain the total of 46,000,000-horse power. A steam horse-power is equal to three actual horses' power, and a living horse is equal to seven men. The steam-engines of the world represent, therefore, approximately the work of 1,000,000,000 men, or more than double the working population of the earth, whose total population amounts to 1,455,923,000 inhabitants. Steam has accordingly trebled man's working-power, enabling him to economize his physical strength, while attending to his intellectual development.

JAPANESE INDUSTRIES. — During the past few years Japanese manufacturing industries have made very considerable progress, and full advantage has been taken of the limited-liability principle. Foreign residents in Japan looked upon the movement with some amount of suspicion, thinking it might be wanting in stability. Recent returns, however, have shown that substantial profits have been earned. In a miscellaneous list of thirty-four companies, the dividends vary from 4 to 26 per cent for the half-year. The Osaka Spinning Company, with a capital of 600,000 yen, distributes 26 per cent to its shareholders; the Tokio Tram Car Company, 21 per cent; and the Osaka Sulphuric Acid Company, 18 per cent. One hundred and sixty-one banks are quoted as paying dividends for the first half of this year varying from 3.2 to 23 per cent, only one bank not paying a dividend at all. Eighty-two paid over 10 per cent, fifteen of these paid 15 per cent and over, and a large number 10 per cent.

WORKSHOP HINTS.

LUBRICANT FOR BRASS. — One part of pure india-rubber melted, and two parts of common vaseline, is said to be an excellent lubricant for brass. It is non-corrosive and lasting.

THE MONKEY-WRENCH. — There is no tool more universally misused than the monkey-wrench. This is usually put on the nut so as to use it backwards, as it is called; that is, so that the strain is brought on the point of the outside jaw: and the shank will be sprung, the jaws opened, and the wrench rendered useless. The bottom of this jaw should receive the strain, as the point of the other is braced so that it is not injured. A monkey-wrench is indispensable to the engineer, and yet their use is limited. As there is so much spring to them, they will not start nuts that are set up hard or stuck, as they spring so as to take off the corners of six-sided nuts, requiring them to be re-dressed, or else replaced by new ones.

TO REMOVE IRON-RUST. — It is often very difficult, and sometimes impossible, to remove rust from articles made of iron. Those which are more thickly coated are most easily cleaned by being immersed in a nearly saturated solution of chloride of tin. The length of time they remain in this bath is determined by the thickness of the coating of rust. Generally twelve to twenty-four hours is long enough. The solution ought not to contain a great excess of acid, if the iron itself is not attacked. On taking them from the bath, the articles are rinsed first in water, then in ammonia, and quickly dried. The iron when thus treated has the appearance of dull silver. A simple polishing gives it its normal appearance.

HOW TO USE GLUE. — For glue to be properly effective, it requires to penetrate the pores of the wood; and the more a body of glue penetrates the wood, the more substantial the joint will remain. Glues that take the longest to dry are to be preferred to those that dry quickly; the slow-drying glues being always the strongest, other things being equal. For general use, no method gives such good results as the following: Break the glue up small, put it into an iron kettle, cover the glue with water, and allow it to soak twelve hours; after soaking, boil until done. Then pour it into an air-tight box, leave the cover off till cold, then cover up tight. As glue is required, cut out a portion and melt in the usual way. Expose no more of the made glue to the atmosphere for any length of time than is necessary, as the atmosphere is very destructive to made glue. Never heat made glue in a pot that is subject to the direct heat of the fire or a lamp. All such methods of heating glue cannot be condemned in terms too severe. Do not use thick glue for joints or veneering. In all cases work it well into the wood, in a similar manner to what painters do with paint. Glue both surfaces of your work, except in cases of veneering. Never glue upon hot wood, as the hot wood will absorb all the water in the glue too suddenly, and leave only a very little residue.

Home, Farm, and Garden.

ARTIFICIAL WARMTH.

The climate of the greater part of this country is such, that, during six to eight months of the year, some method of warming our houses is absolutely necessary. A discussion of some of the various methods in general use may be of interest.

The oldest and simplest method is the old-fashioned fireplace, and from a sanitary point of view it is the best of all. It furnishes ventilation, and warms by direct radiation of heat, rather than by heating the entire body of air in the room. When seated in front of an open fireplace, one can be comfortably warm, even when a thermometer shows quite a low temperature of the air. Unfortunately, however, they do not furnish heat enough for the almost arctic weather of our winters; and the trouble and expense of one or more open fires in every room is prohibitory of their general use. In England the coal-fire in an open grate is the sole means of warming most houses, and their temperature in cold weather is far below that which an American would find comfortable. The cold east wind, so much dreaded by the English, would lose its terrors if a more efficient system of house-warming should be introduced. As a supplementary means of heating, in connection with steam or hot-air furnaces, the open fireplace is strongly to be recommended, both for rendering the room more pleasant and cheerful, and furnishing good ventilation.

Stoves furnish a large amount of warmth at a small expense, but are objectionable on account of the lack of ventilation which obtains in rooms heated by them. With the doors and windows shut, and the draught of the stove nearly closed, the air is breathed over and over again by the occupants, and in a short time becomes vitiated and unwholesome. Although one may after a while become accustomed to this overheated impure atmosphere, it is, none the less, prejudicial to health, and the offensive condition of the air is very apparent to one entering such a room from out of doors.

With proper attention to ventilation, however, the principal objection to the use of stoves can be overcome; and, as they are the most economical means of heating small houses or single rooms, they will undoubtedly continue in general use for a long time to come.

Next to stoves, hot-air furnaces are perhaps most extensively used for heating purposes. They can be divided into two principal classes, — the very good and the very bad. If a furnace is in good condition and perfectly gas-tight, it will in most cases warm a house satisfactorily and healthfully. If, however, it allows any gas to escape into the rooms above, it should be removed or repaired immediately, as the impure air it supplies is very detrimental to health. The chief practical disadvantage is the difficulty of sending the heated air where it is most needed. The tendency is for the hot air to be driven to the rooms on the leeward side of the house, and for this reason a hot-air furnace will be most satisfactory in those houses where the living rooms are on the south side. The coldest winds coming from the north will drive the heat into the occupied rooms; and during the warmer southerly winds, any lack of warmth will not be noticed. The air-supply should always come from out of doors, and never from the cellar; and the larger-sized furnaces should be preferred, as with a small one the fire must be forced in very cold weather, and there is danger of overheating the radiating surfaces. A large amount of air moderately heated is to be desired, rather than a small quantity at a very high temperature.

The advantages of steam-furnaces are their superior heating power, and the ease with which rooms in the most distant parts of the house can be warmed. It is a mistake to suppose that steam heat is any "moister" or in any way different from other kinds. Air warmed by passing over a steam radiator is in no way different from that warmed by a stove or hot-air furnace. In fact, the air is more likely to be impure in a room heated by steam radiators than in one which is heated by a hot-air furnace, from which a current of fresh air is constantly flowing. In what is known as the system of heating by "indirect radiation," the steam radiators are placed in the cellar or underneath the floor, and a current of fresh air allowed to pass around them into the room. This method combines the advantages of both steam and hot air, and is a very satisfactory one.

The greatest objection to steam is the impossibility of regulating the heat in accordance with the outside changes of temperature. If the radiators have any steam at all in them, they must necessarily always be at the same temperature (212°), and the house may be uncomfortably hot; while if the fire is allowed to go out entirely, it becomes too cold. In the system of heating by hot water this difficulty is obviated, for water may be heated to any temperature up to 212°, and thus be regulated as desired. A heating apparatus is in use in which the pipes and radiators are usually filled with hot water; but, in case of very cold weather, the water can be drawn off, and steam used instead. It would seem as if this ought to be a very satisfactory combination.

The most important thing to be borne in mind in all systems of artificial heating is *ventilation*. If a supply of fresh, pure air is constantly introduced into a room, it is of minor importance whether it is warmed by stove, furnace, steam, or hot-water apparatus. There is no need of evaporating water in such a room: that is a matter which will take care of itself. It will, of course, require more fuel to heat a well-ventilated room than one in which the air remains unchanged; but fuel is cheaper than medical attendance. Plenty of pure air at a temperature from 65° to 70° is one of the fundamental conditions of good health; and with the numerous modern inventions in heating apparatus, this can be obtained at a moderate expense, even in such a winter climate as obtains in the northern and north-eastern section of the United States.

CLEANED WHOLE WHEAT AS AN ARTICLE OF DIET.

BY E. CUTTER, M.D., LL.D., NEW YORK.

In August, 1884, I was at my brother-in-law's grist-mill, and noticed the Michigan winter wheat as it came through the smutting-machine clean and fair, ready to be ground. The idea struck me, Why not use this cleaned wheat for food? It is free from dirt, and contains all the form and chemical elements in proper proportions for nourishment that our Creator intended mankind should have when wheat is eaten. We do not crack or grind up other fruits, as tomatoes, apples, bananas, potatoes, etc., for a long time before they are eaten, deprive them of their natural protective garments, and mechanically separate their form elements, so that one-half at least of the nutritious elements are taken away and fed to animals, as we do in wheat.

If the above-named fruits were subjected to such treatment, they would become unfit to eat. Why not, I thought, get the aroma and bouquet of the wheat in the cooking, and not lose it in the milling? Acting on this impulse, I brought home with me a half-bushel of the clean whole wheat, and put my family on to the wheat, to see how long they would live on it without being tired of it. The experiment has been carried out up to the present (more than three years), with no signs of tire.

Modes of Cooking. — My wife, who is my authority, gives the following: For an amount sufficient for four adults, take one cupful of the wheat, wash it clean in cold water; put in a tin pail or crockery bowl, or other suitable utensil, and add a half-teaspoonful of salt and three cups of cold water. Then suspend the pail in a pot of cold water set on a heated stove. Boil eight or ten hours, or cook for the same time in a double water-jacket boiler. A common glue-pot does well for small quantities, or a Chamberlain or other steam cooker may be used. When cooked, it should be soft, adhesive, glutinous, and easily masticated. Serve with butter or milk or cream, or eat it without, as the Asiatics eat rice, with no seasoning.

If the cooking is well done, there is an agreeably nutty flavor of the wheat, which corresponds to the bouquet of grapes. This flavor seems to be lost when the wheat is cracked, crushed, or ground before cooking. If this flavor is not desired, the cleaned whole wheat may be pounded in a mortar or run through a coffee-mill.

This will shorten the time of cooking to four hours and less.

This is a perfect food, and gives all the body tissues a chance to be fed and nourished. It is intended that this should take the place of oatmeal, which has less gluten as compared to wheat, and is harder to digest. It is better than flour. Magendie fed dogs on flour exclusively, and they died in forty days; while other dogs thrived on whole wheat. Judge Abbott of Boston once told the writer about some shipwrecked sailors who were obliged to live on flour alone, and they nearly starved. They could have lived on wheat.

It is more economical than flour. It goes farther, feeds better, and gives better nutritive results than flour. Hence, when money is scarce, and resources have to be husbanded (or "wifed," more truly said), a resort to this food will be very satisfactory.

The objection to the tegumentary coats is not so great as is supposed by some. I have practically tested this point to my satisfaction on my patients. This food is free from yeast, and hence less liable

to fermentation in the alimentary canal. The dangers of loss of health on this food is much less than on flour or sugar. When so much is said of the privation of home missionaries and their ill health, the thought has occurred to me, how much might be saved if this form of food were well known and popular. Even where there are no smutting-mills, the wheat can be used as the old Roman soldier lived on it, carrying a bag of wheat in his pocket on his marches. The less sugar used, the better, as all the starch of the wheat has to be converted into glucose before assimilation. If people were taught to use less sugar, they would know better what are the natural flavors of their food, and like them just as well, if not better, and have much better health. — *Extract from "Food in Motherhood."*

THE ACIDS OF FRUITS.

MR. GEORGE W. JOHNSON, in his *Chemistry of the World*, says, in describing the "vegetable food of the world," "The grateful acid of the rhubarb-leaf arises from the malic acid and bin-oxalate of potash which it contains; the acidity of the lemon, orange, and other species of the genus citrus is caused by the abundance of citric acid which their juice contains; that of the cherry, plum, apple, and pear, from the malic acid in their pulp; that of gooseberries and currants, black, red, and white, from a mixture of malic and citric acids; that of the grape from a mixture of malic and tartaric acids; that of the mango from citric acid and a very fugitive essential oil; that of the tamarind from a mixture of citric, malic, and tartaric acids; the flavor of asparagus from aspartic acid, found also in the root of the marshmallow; and that of the cucumber from a peculiar poisonous ingredient called fungin, which is found in all fungi, and is the cause of the cucumber being offensive to some stomachs. It will be observed that rhubarb is the only fruit which contains bin-oxalate of potash in conjunction with an acid. It is this ingredient which renders this fruit so wholesome at the early commencement of the summer, and this is one of the wise provisions of nature for supplying a blood-purifier at a time when it is likely to be most needed. Beet-root owes its nutritious quality to about nine per cent of sugar which it contains, and its flavor to a peculiar substance containing nitrogen mixed with pectic acid. The carrot owes its fattening powers also to the sugar, and its flavor to a peculiar fatty oil; the horse-radish derives its flavor and blistering power from a volatile acrid oil. The Jerusalem artichoke contains fourteen and a half per cent of sugar and three per cent of inulin (a variety of starch), besides gum and a peculiar substance to which its flavor is owing: and lastly, garlic, and the rest of the onion family, derive their peculiar odor from a yellowish, volatile, acrid oil; but they are nutritious from containing nearly half their weight of gummy and glutinous substances not yet clearly defined."

HOW TO USE CANNED GOODS.

AN "expert," writing to the *Grocers' Chronicle*, points out that canned goods should be turned out and eaten as soon as possible. If kept at all, the food should be covered up and placed in a cool place, — always, however, turned out of the original tin. The liquor around lobsters, salmon, and all vegetables, excepting tomatoes, it is desirable to strain off and throw away. Lobsters and prawns are improved by being turned out into a sieve, and rinsed with clean cold water. Never on any account add vinegar, sauces, or any kind of condiment to tinned foods while they are in the tins, and never eave such mixtures to remain an hour or two, if from forgetfulness it is done. All tinned goods are put up as fresh as it is possible to be, but, unless corned or salted, will not keep if turned out, as freshly cooked goods will, and certainly not longer, as many thoughtlessly suppose or expect they will. Sardines, if preserved in good oil, and if of good quality, will be an exception; as long as the oil is good, the fish can be kept in the tins. But seven days is long enough to trust these before eating. Consumers should not buy larger packages of canned goods than they can consume quickly; if they should, most of the fish and meats can be potted after re-cooking, sauces and seasoning being added. If the nose and eyes are properly used, it is as impossible to partake of an unsound tin of canned food of any kind as to partake of bad meat, fish, or vegetables from a shop.

DO HORSES HAVE HORSE SENSE?

A WRITER in the *Chicago Journal* thinks the intelligence of the horse is greatly over-rated, and submits the result of some of his observations as evidence: —

I have seen horses walk around a post until they had wound up the bridle, and then stand all day with their heads bound down to the post, because they didn't have sense enough to walk the other way, and unwind the bridle. I have seen them get a foot over the bridle, when tied to a ring in the pavement, and then go into fits, because they didn't have sense enough to lift their feet over the bridle again. I have seen them prance around in a burning barn, with their tails and manes on fire, and burn to death, because they did not have sense enough to run out. Anybody can steal a horse without any objection from the horse. A horse will stand and starve or freeze to death, with nothing between him and a comfortable stall and plenty of oats, except an old door that he could kick down with one foot, or that could be opened by removing a pin with his teeth. If this is a high degree of intelligence, even in a brute, then I am lacking in that article myself. Compared with the dog, the elephant, or even the parrot, the horse seems to me to be a perfect fool.

SELECTED RECIPES.

OYSTER SANDWICHES. — Take large stewing oysters, pound them in a mortar (having previously cut off their beards) with a little cayenne and lemon-juice. Spread this mixture on thin slices of brown bread and butter, cut into rounds the size of a silver dollar.

TOMATO SANDWICHES. — Skin half a dozen tomatoes, cut them into slices, pour over them a few drops of anchovy sauce, and then mash them with a little mayonnaise sauce. Grate a little Parmesan cheese over them, and place them between thin rounds of bread and butter.

OMELETTE AS MADE IN FRANCE. — Four eggs, three tablespoonfuls of milk, one tablespoonful of sweet herbs chopped fine (parsley, lemon, thyme, marjoram; dried herbs in the winter), two tablespoonfuls of grated cheese, three ounces of butter. Beat up the eggs, then add the milk, herbs, and cheese. Put the butter into a frying-pan; let boil until it sputters, then pour in the omelette, stir it round carefully one way till it thickens, then shake it a little, so that it does not stick to the pan, and serve up hot.

ICED FRUIT FOR DESSERT. — Select your fruit; small kinds, like currants or berries, being especially suitable. Beat up the whites of two eggs, and mix with a quarter part of water. Have some finely pounded sugar ready in a dish. Then dip the fruit in the egg-water, drain for a minute or so, and roll in the powdered sugar. Lay it on paper to dry, when the sugar will crystallize on the surface, producing a very pretty effect. A mixture of various fruits iced in this manner, and arranged in one dish, presents a fine appearance on the table.

ORANGE CUSTARD FRITTERS. — Break two and a half eggs into a stewpan, with half pound of flour. Mix, and pour in by degrees one pint of milk, and stir over the fire for twenty minutes, when the custard should have become smooth; take it off the fire, and add two ounces of pounded sugar, half an ounce of grated orange-peel, three yolks of eggs, and a dust of salt. Mix these well together, and spread the custard to one inch thickness on a slightly buttered baking sheet. When cold, cut it into pieces two inches by one inch and a quarter; dip the pieces in egg breadcrumb, and fry them in very hot fat till slightly colored; drain, sprinkle them with sugar, and pile them up high on a fancy paper in a dish, and serve.

DEVILLED SARDINES. — Take a tablespoonful of chutney paste, four of cold stock, one of mushroom catchup, one of vinegar, two of made mustard, and two of fresh butter. Mix all these very smoothly together in a deep dish. Put about eight sardines into this mixture, and stew them gently till thoroughly warmed. Soak some thin water-biscuits in sweet oil, then rub each side well over with this mixture, and toast the biscuits on a gridiron over a clear fire. Place them on a dish, lift out each sardine separately, cutting off the heads and tails, split open and bone, and turn each one to fit a biscuit; lay one on each, and brown with a salamander. Serve quickly and very hot as a savory.

ROCK CAKES. — Take two pounds of best white flour, two teaspoonfuls of salt, six ounces of powdered lump sugar, one pound of currants or chopped raisins, half a pound of butter, two eggs, and a pint of milk. Mix together the flour, baking-powder, salt, and sugar, then work in the butter. Next mix in the currants. Thoroughly beat up the eggs, and, still slowly beating, add the milk to them. Lastly, mix up the milk and other ingredients with a spoon into a stiff batter. You must have a good-sized flat, shallow tin, well greased. Upon this drop the stiff batter with a fork in little rough heaps, keeping each heap separate, so that when baked they will have a rough, irregular surface. Bake in a quick oven. Do not make the heaps too large, but so that when baked they will be about as big round as a teacup. Whilst baking try one occasionally with a fork, to see that they are not only nicely done outside of a yellowish brown, but that the inside also is properly baked. If the fork will draw out clear, and not sticky, they are all right.

GLEANINGS.

AN INSECT-CATCHING ORCHID. — It has been ascertained that an Australian orchid belonging to the genus *Masdevallia* possesses a sensitive lip or labellum. An insect alighting upon it is lifted up and caught in a box formed by the lip and other floral organs when the lip is closed. After the lapse of a few minutes the lip relaxes, resumes its former position, and is ready to entrap another insect in the same way. The movements have reference to cross-fertilization.

FRUIT-CANNING IN CALIFORNIA. — The canning of fruits and vegetables in California has increased rapidly within the last few years. It has nearly trebled in a decade, the pack of last season exceeding 760,000 cases, and that of 1887 is estimated to be at least thirty per cent larger, making the production nearly 1,000,000 cases. Eighty per cent of these canned goods are marketed east of the Rocky Mountains, not a few of them being sold for direct export to Europe.

The Popular Science News.

BOSTON, JAN. 1, 1888.

JAMES R. NICHOLS, M.D.
WILLIAM J. ROLFE, Litt.D. } . . . . . *Editors.*
AUSTIN P. NICHOLS, S.B.

SPECIAL NOTICE.

Old subscribers sending us the name of a new one with $1.00 will receive a free copy of Dr. Nichols's book, "Whence, What, Where?" as a premium.

☞ *Those desiring this premium should make a special request for it at the time, or there may be delay in sending it.*

Those wishing to subscribe for other periodicals in connection with the Popular Science News *are recommended to examine the "Clubbing List for 1888," which will be found in the advertising columns. Several changes in the prices since the last season should be especially noted.*

The "total depravity of inanimate things" was well illustrated in the case of the last number of the *Science News*. Both the printing-press and mailing-machine broke down at the most inopportune moment, and caused a vexatious delay in the publication of one of the largest editions of the paper ever issued. In addition to this, some of the printed sheets were misplaced, and a few copies were mailed in which some pages were missing and others duplicated. Any subscriber who has received an imperfect copy, can have it replaced by notifying the publishers. In a short time we shall have improved facilities for mailing the *News*, and shall be able to deliver the entire edition at the post-office within twenty-four hours after it is received from the printer.

Mr. Edison now claims that he has so improved his phonograph as to make it a practical machine for correspondence, and prophesies that it will entirely supplant the typewriter and similar methods for facilitating business. Instead of writing or printing a communication on a sheet of paper, the words will be spoken before the diaphragm of the phonograph, and the vibrations registered on a small piece of tinfoil, which can be sent by mail, and, when placed in another phonograph, will reproduce the words as originally spoken. If the improved instrument will do all that its inventor claims, it will undoubtedly be of the greatest value; but it is characteristic of Mr. Edison to be rather sanguine in regard to the capabilities of his inventions, and upon actual trial it may be found that there are still difficulties to be overcome before the phonograph will be a familiar object in counting-rooms and business offices.

It is a familiar fact in chemistry, that, under certain conditions, iron may be placed in concentrated nitric acid without any reaction taking place. This is called the "passive state" of the metal, and is probably due to the formation of a film of insoluble oxide upon the surface. This "passivity" is destroyed at a high temperature, and the iron dissolves in the acid in the usual manner. Messrs. Nichols and Franklin (*American Journal of Science*) have found, that, by exposing this passive iron in acid to the influence of a powerful electro-magnet, the temperature at which the reaction commences is greatly lowered, and that the general tendency of the magnetic force is to change the passive iron into the ordinary condition. The observation is a most interesting one, and the phenomenon deserves a more extended investigation.

Messrs. Hutchins and Holden give, in the same journal, an account of certain investigations upon the solar spectrum, which seem to prove the presence of the metal platinum in the sun's atmosphere. This is the first time any lines corresponding to that element have been observed. They also find additional evidence of the presence of cadmium, bismuth, and silver, which have always been considered doubtful; while the presence of lead, tin, potassium, lithium, and the cerium group, is not confirmed.

Professor Gustav Robert Kirchoff, one of the most eminent physicists in the world, died at Berlin on the 17th of October, in his sixty-fourth year. He will be remembered as the colleague of Bunsen in their investigations upon spectrum analysis, — one of the most important scientific discoveries ever made. He also published numerous valuable papers upon electricity and dynamics. In the latter years of his life, owing to impaired health, he was unable to actively continue his work; but few men have done more than he to advance the cause of science.

There is a tendency at present among sanitarians to attach less importance than formerly to the agency of sewer-gas in the production of diseases like diphtheria, typhoid-fever, etc. In the Proceedings of the Royal Society is a paper on this subject by Professor Carnelly and J. S. Haldane, M.B., in which it is shown that the air of large and well-ventilated sewers is comparatively free from noxious gases, and contains proportionately fewer micro-organisms than the outer air of the same locality. These observers also found that most of the micro-organisms found in the sewer-air were drawn in from the outer air, and not developed in the sewer, and that micro-organisms tend to settle instead of remaining in the air. It has also been suggested that the dry and crumbling deposits around leaks in the pipes, and upon unused fixtures, may be more productive of the dangerous disease-germs than the air of the sewer itself. It is certainly true that if sewer-gas were as deadly as has been claimed, few persons would be left alive. The proportion of houses in which the plumbing is tight and perfect is very small, especially among those built ten or fifteen years ago. But, although the dangers of sewer-gas may possibly have been over-estimated, it is better to run no risk; and if we can succeed in keeping it out of our houses, we can be certain that we have also kept out any germs of disease which may accompany it. In matters of health every possible precaution should be taken, and the dangerous nature of faulty plumbing and drainage admits of no question.

The question of government postal telegraphs is likely to be brought prominently into notice during the present session of Congress. It is a well-known principle of political economy that any industrial undertaking can always be carried on much more efficiently and economically by a private company than by a government bureau or commission, with its lack of responsibility and interest on the part of the officials and employés. The postal department has been cited as an exception; but, although the service is very satisfactory, there is no doubt that it could be carried on by a private company at a large profit, instead of, as at present, with an annual deficit of several million dollars. We are glad to note that the sentiment of nearly all our exchanges is opposed to any such foolish and unnecessary scheme.

PREHISTORIC RELICS AT PANAMA.

Dr. Saint-Maurice, a physician employed by the Panama Canal Company, gives in *La Nature* an interesting account of certain prehistoric rock-sculptures found in the Obispo valley. The engraved stones are blocks of

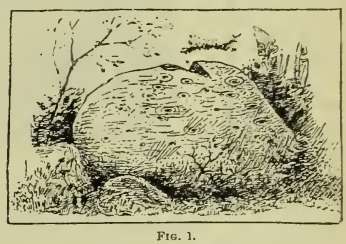

Fig. 1.

trachyte which have been worn by the action of the elements till they closely resemble glacial bowlders, although their occurrence is hardly probable in so southerly a latitude.

One of these stones (Fig. 1) has on its surface numerous little depressions surrounded

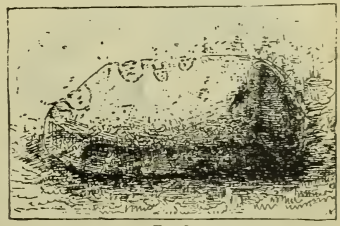

Fig. 2.

by concentric circles. They are arranged with some regularity, and may have been intended as a landmark or guide-post.

At a distance from this stone is a group of four, three of which are shown in the accom-

panying engravings. One is engraved with a number of human faces, some of which are drawn with small horns on the forehead; another has only one face, quite deeply cut; another has a sort of scale divided into six-

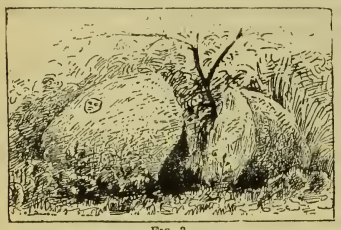

FIG. 3.

teen parts; while the fourth stone, which is not illustrated, is marked with two crosses, very much defaced, and a kind of horizontal cartouche rounded at the extremities and divided into eight parts. The horns with which the human faces in Fig. 2 are drawn, recall to mind the passages in the Bible where the "horn of the righteous" is referred to.

The significance of these markings is unknown; but the depressions, circles, crosses, and graduated scales bear a curious resemblance to the marking on certain prehistoric dolmens in France and England, notably one near Plouharnel in Brittany. Their age is uncertain. They doubtless belong to the neolithic or polished-stone age, as is shown by the numerous stone implements and weapons found near them; but there is no means of knowing how long ago that epoch occurred on the isthmus, although it was many years probably before the time when the wonderful

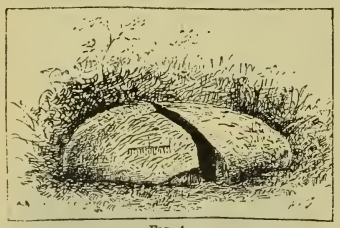

FIG. 4.

buildings and monuments of Mexico and Yucatan were erected. This ancient civilization never flourished on the Isthmus, but was confined to the countries to the north and south. No ancient ruins or burial places have been found in the region adjoining the Panama Canal.

Farther to the north, near Cheriqui, specimens of ancient pottery, both domestic and votive, are constantly being discovered. The illustration (Fig. 5) is taken from a photograph of some of the finest examples, which resemble in some respects the pottery from Cyprus in the collection of the New York Metropolitan Museum, as well as some specimens of Etruscan origin.

We do not think that the resemblance between either the rock-markings or the pottery of the western and eastern hemispheres is a matter of very great significance, as indicating that they were the work of the same race of men. Certain forms, like the circle or the graduated scale, are common to the understanding of mankind in general; and the pottery of a rude and unskilful people in any part of the world would have many points of resemblance from the very nature of the case. Still, a connection between the Old and New World in times long before the discoveries of Columbus, is not an impossibility. Future explorations in Mexico and Central America may shed new light on the question, and give us more certain knowledge as to how the American continent was originally peopled.

FIG. 5.

THE DISSOLVING SPECTRE.

A CURIOUS OPTICAL ILLUSION.

A WRITER in a recent number of *La Nature* describes a most ingenious and beautiful optical illusion, which requires no apparatus except

FIG. 1.

a piece of plate-glass, and can be performed by any one for a winter evening's amusement.

A small stage is improvised in a doorway between two adjoining rooms. The opening facing the audience should be from one to two feet square, and all parts of the stage must be covered or draped with perfectly black paper or cloth. When all is ready, the door is opened, and in the centre of the stage is seen a plaster or pasteboard head (Fig. 1). The

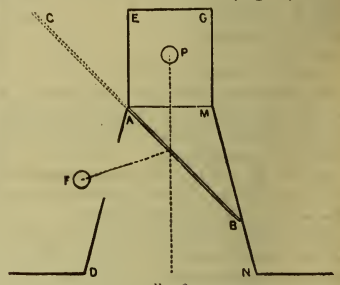

FIG. 2.

exhibiter takes it up and passes it round among the audience, and then returns it to its place. It immediately begins to take on a lifelike expression: the eyes open, the lips smile; and in a few moments the inanimate figure is transformed to a living human head, which even speaks or sings. This begins shortly to fade away, and is transformed into a cabbage, which in turn is replaced by an empty dish which becomes filled with fruit or flowers, which are passed round among the audience. On restoring the dish to its place, it passes through numerous other transformations, ending finally in the original plaster cast.

The accompanying diagram (Fig. 2) explains the simple means by which these puzzling effects are produced. The line *NMAD* represents the front part of the miniature stage, at the back of which is a table, *AMEG*. Placed diagonally across the stage at *AB* is a piece of plate-glass which completely fills the opening. At *P* is placed the plaster bust, and at *F* the living head into which it is to be transformed, the rest of the body being concealed. Two lamps or gaslights are arranged so as to strongly illuminate the objects alternately.

At the beginning the back part of the stage is illuminated, while the side at *F* is in darkness. The light from the object at *P* passes directly through the glass, which is not visible; and the bust is in full view of the audience. Then, if the light at *P* is slowly turned down while that at *F* is raised, the artificial bust will appear to transform itself into the living head; the sheet of glass now acting as a mirror, and reflecting the image of the object at *F* towards the spectators. Meanwhile an assistant has placed the cabbage or other object at *P;* and

when the light at the side is lowered, and that at the back raised again, the second transformation takes place: and thus the exhibition can be continued indefinitely.

In order that the plaster bust may be removed from the stage for inspection, the glass must be arranged so that the assistant behind the scenes may slide it away toward *C* at the right moment. As the glass is not set in any frame, the movement will not be noticeable, especially if the front part of the stage is rather dimly lighted. Care must be taken to have all parts of the stage completely covered with black cloth or paper, so that the backgrounds on which the images appear shall have the same appearance in each case. Plate-glass is much the best for this experiment; but, as it is rather costly, and not always to be obtained, a good quality of ordinary "German" window-glass may serve a good purpose. The size is unimportant, as the stage opening may be made to fit any available piece of glass; and smaller objects may be used for the dissolving views if the glass is too small to admit of the reflection of a living head. The minor details and precautions will suggest themselves to any one who attempts to produce this entertaining optical illusion, which we especially recommend to the attention of our younger readers.

A MAMMOTH SNOW-FLAKE.

The engraving represents in its natural size a single snow-flake which fell at Chepstow in Wales on the 7th of January last. It measured 3.6 inches in length, 2.4 in breadth, and 1.3 in thickness, and when melted gave about one-half a cubic inch of water. It was composed of numerous separate crystals which had adhered together while falling through the air. The atmospheric conditions were very favorable for the formation of large flakes, as the temperature was just above the freezing-point, which rendered the snow moist and coherent, and the air was perfectly calm and saturated with moisture.

During this storm the snow fell in remarkable quantity. About one-fifth of an inch fell in six minutes, which when melted was equivalent to about one twenty-fifth of an inch of water.

This is certainly one of the largest snow-flakes on record; and if any of our readers observe any of equal or larger size during the present winter, we should like to be informed of their dimensions.

[Specially reported for the *Popular Science News*.]

METEOROLOGY FOR NOVEMBER, 1887, WITH REVIEW OF THE AUTUMN.

TEMPERATURE.

Average Thermometer.		Lowest.	Highest.	Range.
At 7 A.M.	33.00°	17°	56°	39°
At 2 P.M.	46.57°	21°	66°	45°
At 9 P.M.	35.50°	10°	54°	44°
Whole month	38.36°	10°	66°	56°
Second average	37.64°	10°	66°	56°
Last seventeen Nov's	38.06°	31.12°, in 1873.	42.51°, in 1877.	11.41°
Second average	37.68°	30.62°	42.36°	11.74°
Autumn of 1887	48.13°	10°	78°	68°
Last seventeen autumns,	50.15°	47.53°, in 1875.	53.57°, in 1881.	6.04°

The last day of the month was emphatically the coldest, by more than ten degrees, having an average of only 16°; the closing observation (10°) was the lowest point. The warmest day was in near proximity, the 27th, with an average of 52⅔°; indicating a very sudden change. In three days following, the mercury went down 44°. The highest point reached was 66°, on the 4th and 7th. From the 26th to the 28th was unusually warm for the season, suddenly followed by cold, as unusual. The entire month was three-tenths of a degree above the average of the last seventeen Novembers, while the autumn was nearly two degrees below that average (see the table). The extreme autumns have been 47.53°, in 1875, and 53.57°, in 1881,—a range of over 6°. Only two autumns have been colder than the present in seventeen years.

SKY.

The face of the sky in 90 observations gave 52 fair, 17 cloudy, 13 overcast, 7 rainy, and 1 snowy,—a percentage of 57.8 fair. The average fair for the last seventeen Novembers has been 55.5, with extremes of 40 per cent, in 1885, and 74.4, in 1874. Four mornings were foggy, of which three were consecutive, on the 25th to 27th, and very dense, especially that on the 26th, which continued through most of the day and evening. The average fair during the autumn was 55.8 per cent, while that of the last seventeen autumns has been 57.9 per cent, with extremes of 43.9, in 1882, and 69.2, in 1874.

PRECIPITATION.

The amount of rainfall the past month was 2.42 inches, while the average for the last nineteen Novembers has been 3.92, with extremes of 1.10, in 1882, and 7.45, in 1877. The rain fell principally on six days; the largest amounts were .90 inch, on the 15th, and .76, on the 10th. A trace of snow, the first in the season, fell on the 11th. The amount of precipitation since Jan. 1 has been 40.21 inches, while the average for this period has been 41.80. The amount of precipitation through the autumn has been 5.76 inches, while the average for the last nineteen autumns has been 10.41, with extremes of 3.42, in 1874, and 20.08, in 1869 (including a flood). The next highest amount was only 14.10, in 1872. The amount the present autumn has been the lowest, with one exception, in nineteen years.

PRESSURE.

The average barometer the last month was 29.976 inches, with extremes of 29.29, on the 11th, and 30.68, on the 30th. This is a remarkably high figure; and though just equalled in March last, it has been exceeded but twice in fifteen years. The first two-thirds of the month the pressure was very changeable, with no very low depressions; while the last third was more steady, ending the month very high, and still rising. The average pressure for the last fourteen Novembers has been 29.977 inches, with extremes of 29.840, in 1878, and 30.193, in 1880. The sum of the daily variations the past month was 7.14 inches, giving an average daily movement of .238 inch. This average in fourteen Novembers has been .231, with extremes of .127 and .293. The largest daily movements were .69, .67, and .63, all in connection with rainfall. The average pressure for the last autumn was 30.021 inches, that of the last fourteen autumns 30.001 inches, with extremes of 29.881, in 1875, and 30.070, in 1880.

WINDS.

The direction of the wind in 90 observations gave 16 N., 1 S., 3 E., 24 W., 6 N.E., 20 N.W., 1 S.E., and 19 S.W.,—an excess of 21 northerly and 53 westerly over the southerly and easterly, and indicating the average direction of the month to have been W. 21° 37′ N. The westerly winds in the last eighteen Novembers have uniformly prevailed over the easterly, with an average of 48.89 observations, and the northerly over the southerly, with four exceptions, by an average of 14.22; indicating the approximate general average for November to be W. 16° 13′ N. The longitudinal extremes in eighteen Novembers have been 7 and 73 W.,—a range of 66 observations; and the latitudinal 44 N. and 12 S.,—a range of 56. The relative progressive distance travelled by the wind the last month was 57.01 units, and during the last eighteen Novembers 880 such units,—an average of 50.92; showing less opposing wind the past month than usual. The winds were 5° 24′, or near half a point more northerly than the average, and yet the month was a trifle warmer than usual. The average direction of the wind the last autumn was W. 25° 29′ N., while the average for the last eighteen autumns has been only W. 11° 30′ N.; showing the influence of the more northerly winds, and also greater cloudiness, in producing the cool autumn.

D. W.

Natick, *Dec.* 6, 1887.

[Specially reported for the *Popular Science News* from the Observatory of the College of New Jersey.]

ASTRONOMICAL PHENOMENA FOR JANUARY, 1888.

Mercury cannot be seen during the month. It passes superior conjunction with the Sun on Jan. 18. Venus is still a morning star, rising about three hours before the Sun. This interval will be somewhat diminished by the close of the month. Mars is gradually growing brighter, and rises earlier than before. It is in quadrature with the Sun on the morning of Jan. 5; that is, it is on the meridian about 6 A.M. It rises at about midnight on Jan. 1, and at about 11 P.M. on Jan. 31. It is near the first-magnitude star Spica (*Alpha* Virginis), and during the month moves from a point about 7° west, to a point about 4° east, of the star. Jupiter rises at about 4 A.M. at the beginning of the month, and at about 2.30 A.M. at the end. On

the morning of Jan. 2 it is very near Venus, about 2° south; and on Jan. 24 it passes just north of the second-magnitude star *Beta* Scorpii, at a distance of only 8′. Saturn is moving slowly westward in the constellation Cancer, and comes to opposition with the Sun on Jan. 22; that is, is on the meridian at midnight. It lies between Regulus (*Alpha* Leonis) and Castor and Pollux, rather nearer the latter stars. Uranus is nearly stationary among the stars, and is about 4° west and 4° north of Spica. Neptune is south of the Pleiades.

There will be a total eclipse of the Moon on Jan. 28, which will be visible throughout the United States. Total eclipse begins at about 5*h*. 30*m* P.M., Eastern Standard Time, and ends at 7*h*. 9*m*. P.M.

Constellations. — The followiug positions of the principal constellations give their place at 10 P.M. on Jan. 1, 9 P.M. on Jan. 16, and 8 P.M. on Jan. 31. Auriga is near the zenith; the principal star, Capella, being a little north. Orion is just coming to the meridian on the south, about halfway between zenith and horizon. Below and a little east of Orion is Canis Major, with Sirius, the brightest of the fixed stars. Nearly on the same level, and east of Orion, is Procyon, the principal star of Canis Minor. Near the eastern horizon is Leo; above this, Caucer (Saturn is now in this constellation), and above Cancer, and near the zenith, is Gemini. On the north-east is Ursa Major, the two pointers being nearly as high as the Pole Star, and the handle of the dipper pointing downwards. The greater part of Ursa Minor is under the pole, and the brightest stars of Draco are very close to the northern horizon. Perseus is near the zenith in the north-west; below it is Cassiopeia, and Cygnus is on the horizon. Andromeda is a little north of west, below Perseus; and Pegasus is just below Andromeda. Pisces is just west of Pegasus; above Pisces is Aries; and above Aries, and near the zenith, is Taurus, with the groups of the Pleiades and Hyades. Cetus is in the south-west, and Eridanus a little west of south.

M.

PRINCETON, *Dec.* 3, 1887.

Correspondence.

Brief communications upon subjects of scientific interest will be welcomed from any quarter. The editors do not necessarily indorse all views and statements presented by their correspondents.

PARASITES OF THE HOUSE-FLY.

NEW BRUNSWICK, N.J., Nov. 11, 1887.

EDITORS POPULAR SCIENCE NEWS:

LAST year I sent you a communication upon the supposed parasites of the common house-fly. Your account of M. Mégnin's study of the same did not hit the nail on the head, for a further examination convinces me that flies on this side of the ocean are infested with a parasite far different from that described by Mégnin. [See *Science News* for December, 1886.]

The bright-red color would certainly have been noticed by him. Besides, the extreme abundance of these I have noticed, would have been a special point. One evening in September I observed a fly to light on my study table; and upon catching it, I found, by the aid of the microscope, no fewer than *fifty-six* parasites. After removing fifty-three very carefully, keeping nearly all alive on a sheet of paper, I noticed very closely attached to the breast of the fly another kind. It was carefully removed, and placed under the microscope; and behold! there appeared the exact form of that described by Mégnin, and illustrated in your valuable journal last year: and its adherence to the fly was apparently by the same means as he described. Once before, I found fifty-five of the red kind, and again over forty. They are of an oval form, with microscopic hair-like legs, with powers of locomotion exceedingly limited; and the wonder is to me, how they can obtain access to the body of a fly, and remain so tenaciously fixed to him. I also wonder that full accounts have not been written by those able to do the subject full justice. It can hardly be possible that they have escaped notice.

Very truly,

CHARLES JACOBUS.

DO WORMS FALL DURING SHOWERS?

EDITORS POPULAR SCIENCE NEWS:

WILL you please inform me what you consider the facts with regard to the appearance of earth-worms, or angle-worms, after some rainfalls. Do they come down? We know they may come up. I am aware that some seemingly good authorities are entirely incredulous with regard to their falling, yet my experience teaches me differently. I will give one instance. During a recent rainfall, there stood in my yard a large dry-goods box; upon the top of this were several milk-crocks. One was turned bottom up; and upon this was one, top up and empty. It was placed there after being washed, to sun and air, just before the shower; it being in frequent use for milk. After the rain, there was in the crock three-quarters of an inch of water and an *earth-worm* five inches long; the worm in this instance, like the rain, having, as I believe, but one way to get in, and that by falliug from the clouds.

This may be an old query, but a modern explanation will greatly oblige a subscriber.

J. H. H.

HAMPTON, IO., *Oct.* 1, 1887.

WE are unable to explain the occurrence related by our correspondent, but doubt very much if an animal of the size described could fall from the clouds during a shower. Perhaps some of the readers of the *News* may have observed similar occurrences. — EDS.

QUESTIONS AND ANSWERS.

LETTERS of inquiry should enclose a two-cent stamp, as well as the name and address of the writer, which will not be published.

QUESTIONS regarding the treatment of diseases cannot be answered in this column.

M. S., *New York.* — I observe, on holding a bottle of vinegar to the light, that it seems to be filled with minute animalculæ. What are they, and what is their nature?

Answer. — These little "wrigglers" are known as vinegar eels, and are very often found in vinegar. They are living animals, but are perfectly harmless, and, if any thing, indicate that the vinegar is of good quality. A drop of vinegar containing these eels is a most interesting object under the microscope.

S. C., *Alabama.* — What will remove the nicotine and offensive odor from tobacco-pipes?

Answer. — We do not believe that this can be satisfactorily accomplished. The common clay pipes can be placed in the fire and burnt clean; but this, of course, would destroy meerschaum or other expensive kinds. The best way to have a clean pipe is, to use cheap ones that can be thrown away after they become saturated with the products of the combustion of tobacco.

SUBSCRIBER. — What is the cause of the unpleasant odor of the water in my cistern? It has been thoroughly cleaned out, and there is no apparent source of contamination.

Answer. — It would be very hard to say positively what was the cause of the change in the water. We receive a great many inquiries similar to the above, and are forced to conclude that it is due to some cause not generally known. Perhaps some of our readers can suggest a remedy. The only general precautions to be taken are perfect cleanliness, ventilation of the cistern, and exclusion of small animals and insects, which often fall into cisterns sunk in the ground.

LITERARY NOTES.

The New Astronomy. By Samuel Pierpont Langley, Ph.D., LL.D., director of the Allegheny Observatory. Ticknor & Co., publishers, Boston. Price $5.00.

In this magnificent work Professor Langley has given a most interesting account of the celestial bodies, their nature and phenomena. It is written in a strictly popular style, and can be understood and enjoyed by those having no previous knowledge of the science. It is profusely illustrated with beautiful wood engravings, which are for the most part copied from original drawings by the author and others. The "new astronomy" is really only the modern development of the old, and Professor Langley has done his full share towards the advancement of the science. The work is equally creditable both to author and publishers, and we are pleased to recommend it to the attention of our readers.

The Art of Projecting. By Professor A. E. Dolbear of Tufts College. Lee & Shepard, publishers, Boston. Price $2.00.

The use of the *porte lumière* and magic lantern as a means of illustrating physical and natural phenomena to large audiences or classes of students, is continually being extended, and in many cases has become almost a necessity. This second edition of Professor Dolbear's work treats the subject very fully, describing all the different forms of apparatus, and the various sources of illumination. Teachers of science will find it a most valuable aid in their demonstrations to their classes. An appendix gives a short account of the phenomena of vortex rings, with directions for their production.

The same firm also publish *Pre-Glacial Man and the Aryan Race*, by Lorenzo Burge. Price $1.50. It is a most remarkable combination of theology, geology, ethnology, and mythology, and, as a scientific romance, is quite entertaining; but its value as a sober work of science is very small.

Studies in Civil Government. By William A. Mowry, Ph.D. Introductory price, 94 cents. Silver, Rogers, & Co., Boston, publishers.

This book was prepared by a teacher. It evidently grew out of his own experience. It is a simple, straightforward text-book, treating first of the local government and then of the state and the nation. The town and city governments are clearly portrayed, naming the officers, stating their manner of election, and giving a brief *résumé* of their duties. The Constitution of the United States is carefully considered in detail, and explained in a manner at once interesting and within the comprehension of the ordinary scholar in the high school or the upper-grade grammar school. It is full of useful information, is methodically arranged, and is written in a clear, interesting, and animated style.

600 Medical Don'ts. By Ferdinand C. Valentine, M.D. G. W. Dillingham, publisher, New York.

The purpose of this book is not only to give practical information on medical and hygienic matters to laymen, but also to establish a better relationship between them and the professional physicians. The six hundred maxims which compose the book comprise many valuable hints. The peculiar style in which they are written will assist in impressing them upon the memory, and there are only a few which are not well worth remembering.

Messrs. P. Blakiston, Son, & Co., Philadelphia, publish a small but complete monograph on *The Urine* (price 50 cents), by J. W. Holland, M.D. It is arranged in note-book form, and gives full directions for the chemical and microscopical examination of the fluid. The microscopical appearance of the different deposits are shown in engravings, and physicians will find it a most useful aid to a correct diagnosis of a large class of diseases.

A Handbook of Volapük is announced by Charles E. Sprague of 1271 Broadway, New York. Price $1.00. Those who have read the interesting account of the new language in our November number, will be glad to learn that a text-book can now be obtained in this country at a low price.

The *Index Rerum*, published by Joel A. Miner, Ann Arbor, Mich., at $1.25, is adapted for an index to newspaper and other clippings, and also as a physician's account-book. Larger sizes of the *Index*, especially adapted to legal and medical subjects, are also published, which will be found superior to a scrap-book, and much cheaper than the expensive cabinet-files.

Pamphlets, etc., received: *The Classification of Vesical Calculi*, by A. Vanderveer, M.D., Albany, N.Y.; *The Undeveloped South and its Resources*, by George B. Cowlani, Louisville, Ky.; Monthly *Bulletins* of the Iowa State Board of Health and the Connecticut Agricultural Experiment-Station.

Medicine and Pharmacy.

ARE AMERICANS A NERVOUS PEOPLE?

The term "American nervousness" has become almost proverbial, and it is a popular belief that the nervous temperament is eharaeteristie of the inhabitants of the United States; that all our affairs are eonduoted on the "high pressure" system, and that our normal state is one of the highest excitement. To this alleged state of affairs is attributed the numerous "break-downs" and eases of nervous prostration and insanity so frequently reported.

Like many other generally accepted beliefs, we think there is but little aetual foundation in fact for sueh an idea. The average American is well fed, warmly clothed, and properly cared for in every way. His average weight and size are fully equal to those of his transatlantie brother; and the tall, sallow, lean, and excitable individual supposed to represent the typical American, like the conventional Yankee or Irishman, is only to be found between the covers of novels or in dramatic representations.

Let any one make a mental review of his aequaintanees, and we venture to predict that the number of those who ean fairly be eonsidered as "nervous" will be very small. One meets as many persons in England or Germany who answer to this "American" type as in our own country. We have watehed the proceedings of the stock exchanges both in Berlin and New York, and can bear evidence to the faet that the supposed stolid and quiet Germans attain a degree of exeitement in their business dealings whieh is far beyond that exhibited by their Amerioan brethren. The dryer and more exhilarating climate, and the soeial and political eonditions of this eountry are more favorable to business aetivity and industrial enterprises than is the ease in European eountries; but the nervous temperament is not dependent upon these conditions at all, but to causes which prevail in all parts of the world. The immense systems of transportation, and the enormous mereantile and industrial operations earried on in this country, eould not be managed by nervous men, or by any but those in the most perfeet and robust health.

It is a significant faet that the elass of funetional nervous diseases to whieh the late Dr. Beard applied the term "neurasthenia," were first speeially studied and deseribed by German physicians. The Germans have been generally considered as being any thing but a nervous race, but the same trouble whieh is popularly eonsidered as a peculiarly Amerioan one oecurs among them as well as ourselves.

We cannot, then, come to any other eoneluslon than that the Amerieans, as a people, have as strong nerves and as vigorous constitutions as any nation on earth. With the general adoption of modern eomforts and eonveniences, and the better sanitary conditions under whieh we live, the death-rate is eonstantly diminishing, and the average length of life increasing; and there is no reason why we should not claim for ourselves as much superiority in health and strength as we are accustomed to do in business and political enterprise and sagacity.

SANITARY SCIENCE AND DOMESTIC ARCHITECTURE.

BY JOHN CROWELL, M.D.

III.

In every well-planned house ample room must be apportioned for sleeping-apartments. Too often such vital conditions are neglected for the sake of a multiplicity of rooms, and we find honses with spacious halls and drawing-rooms, without any thought bestowed upon the places to be used for sickness and for the hours when tired nature seeks repose. A sleeping-room should be generous in size, open to the sunlight, and as free as possible from superfluous furniture and ornament. It should have the sunshine, for the sake of ventilation and dryness; and it should be simple in furnishings, because of dust and "germs" of disease.

Modern luxury has made sleeping-rooms receptacles for elegant appointments; and we find them filled with numberless articles of fanciful design, — knickknacks, draperies, rugs, carpets, and every conceivable thing that æsthetic taste can invent. Hence there can be no pure air in such rooms, and the accumulation of *filth* and dust is something wonderful. While we would not strip these rooms of all artistic adornment, we insist upon simplicity; and first of all, we would discard heavy woollen carpets. They are filthy; and if the good housewife does not believe it, let her look across the room when the sun is shining through it, and see the line of dust constantly rising. Of course, this process goes on night and day, and it is unavoidable when the floor is encumbered with the woollen covering. Let the floor be laid in solid wood, — birch thoroughly kiln-dried is perhaps the best, — and let there be no cracks or seams for dust and vermin. A few closely woven rugs can be disposed in front of bed and toilet table, and these can be removed and shaken every day, while the floor is wiped with a damp cloth The moral influence of such cleanliness is certainly conducive to sleep, to say nothing of the direct sanitary effects. Bare walls are better than paper hangings, even when the paper is free from arsenic; and with the soft, warm tints at the disposal of the painter, the walls can be made to glow with cheerful light.

Sinks with hot and cold water, connected with the sewerage system, should be discarded for obvious reasons; and in all houses where these fixtures pollute the sleeping-room, there should be a complete revolution in their removal. Not one in twenty of these filthy receptacles is securely trapped; and with the old devices of chain, plungers, overflow pipes, and leaky crevices, we are at variance with all sanitary rules and conditions. Let all such "conveniences" be relegated to the bath-room, with the open plumbing suggested in a former paper.

It is better to go back to the old wash-hand stand than to endanger the health with any such superfluous trappings. An open fireplace is not only a luxury, but a necessity as a mode of ventilation; and then, with iron or brass bedstead, with woven wire bottom and hair mattress, and with simple window-shades or shutters, we shall have a sleeping-room combining the requisite conditions for cleanliness and health.

A nursery should be furnished with still more rigid simplicity, with ample space for the free movement of the children with their baby pastimes. The walls may glow with the adornment of bright pictures, and the attractive furnishings of child-life should not be lacking. But draperies should be discarded, and carpets, if used, should be of the simplest and most closely woven texture. A room that can be easily kept clean and easily ventilated, light, open, and cheerful, is the place for the nursery.

The kitchen should receive special attention, for it is here where the important work of the household is done. And yet how often is this apartment neglected in the plan of the house, and crowded away in some angle, small, dark, and inconvenient. A kitchen should be at least fourteen feet square, with ample arrangements for range, sink, and other culinary appliances. The sink should be thoroughly trapped, the water that supplies the tank should *not* come from the cistern that feeds the water-closets, and the drip-pipe of the refrigerator should not enter the general sewer. The backs of sinks and wash-tubs should be protected with high soapstone slabs, to prevent the accumulation of moisture and filth; and care should be taken that no waste material finds lodgement in any of the crevices or traps. Open plumbing should be observed, and no place should be found under the sinks for mops and rubbish. The floor should be solid and seamless, with grooved edges where it joins the mopboard. This coucave line prevents the accumulation of dust and vermin, and greatly facilitates the process of cleaning the floor.

It is desirable to have the kitchen shut off from direct communication with the dining-room, in order to avoid the odors and steam incidental to cooking. The pantry and china-closet should intervene between kitchen and dining-room, where, by means of slides, the food and china can be served without inconvenience. By this arrangement also the noise of the kitchen is shut out from the dining-room. Nothing makes the work of the kitchen move on so smoothly among the servants as to have at their command the conveniences of a well-planned kitchen and pantry. A dinner-party often proves a failure because of the scanty surroundings of the culinary apartment. Let no architect, therefore, think that he has done a fine thing unless he has given thought to the practical working of the kitchen. Oftentimes a house with elegant appointments in hall, library, and drawing-room, is provided with a kitchen so cramped iu space; the range, sink, and working-table being in such close proximity, as to interfere with the necessary operations of that important apartment. The transition from kitchen to dining-room is quite natural, and this room should have easy access to the kitchen without a direct communication. A short hall or entry should intervene, for the sake of protection from the noise and odors. Entrance to this room should also be had from the hall or drawing-room. The dining-room should be of generous size, capable of seating at table at least tweuty persons. This room is very apt to be too narrow, making it difficult for guests to be served without crowding them. Twenty-five by fifteen feet is noue too large in a good-sized house; but we often find the room cramped into a space twelve by fifteen feet, to the great embarrassment of the host upon special occasions.

In decorating and furnishing this room, we must study propriety. It should differ from other rooms inasmuch as its uses are different. It should be inviting and hospitable, with nothing in excess either in coloring or furnishing. As the hour spent aromnd the family board should be oue of the most delightful of the day, so should the room have that cheerful, restful look so refreshing to the tired hands and weary brain; for we need something besides the act of eating to build up the waste places in our exhausted forces. Let the room glow in

subdued harmony of coloring. The ceiling will bear some tinting, but do not let the plasterer waste his mortar in massive stucco-work. Heavy cornices, panellings, and centre-pieces loaded down with masses of heavy lines in fresco, are in bad taste in a small room. Elegant and expensive styles can be devised with the aid of a good architect. The mediæval mouldings, with their infinite variety of tracery and capital, furnish a rich field of suggestion for mantel and sideboard. But do not run into the Grecian forms, with the tiresome sameness of fluted columns and acanthus foliage. The Greek styles bind you down in close servitude, while the Gothic unfold a never-failing source of shape and ornament. The Gothic idea can be carried into the ceiling, with oak ribs and riblets in panelled designs Rare old china, or the odd bits and shapes in ceramics that have come down as heirlooms, can be arranged around the room on brackets, or displayed in a quaint cabinet with glass doors. A great variety is offered in wall decorations in shape of rich medallions, bronzes, and articles of *virtu;* while good engravings from the masters, and a few oil paintings, are desirable, but these need not all be suggestive of slaying and eating. The floor should be laid in solid wood in mosaic patterns or tile border, with a large rug of firmly woven texture under the table.

Inside shutters or simple shades will modify the light from the windows; but if draperies are used, they should be hung with rings upon rods, for easy adjustment. The thick textures in rich Oriental patterns arranged in this manner add to the warm, cosey look of the room on a cold night, when the house is open for guests, or when the family surround the board for the evening meal. By observing some of these hints and suggestions, the healthiness and beauty of the dining-room may be distinct and satisfying.

HAVERHILL, MASS., *December*, 1887.

[Specially compiled for the *Popular Science News.*]

MONTHLY SUMMARY OF MEDICAL PROGRESS.

BY W. S. WELLS, M.D.

THE *British Medical Journal* says of saccharine tabloids: "This remarkable product of chemical science is likely to come rapidly and extensively into use, and these tabloids are of a most convenient form for ordinary domestic purposes. One tiny tabloid dropped into a cup of coffee or tea, sweetens it most agreeably and inocuously; and thus the diabetic or glycosuric patient, who has been so long deprived of the pleasure of sweetening his food, can carry a little glass tube of these tabloids in his waistcoat pocket, using them as he would lumps of sugar. One tabloid is the full equivalent in sweetening-power of an ordinary lump of white sugar. Saccharine is not easily soluble in water: these tabloids are therefore intelligently mixed with just enough alkali to make them perfectly soluble."

DR. HIDALGO of Mexico reported to the Academy of Medicine of that city, at a recent meeting, the case of a man who had been struck by lightning, and was at first thought to be dead, but who, after having had cold water thrown over him at the suggestion of a passer-by, recovered consciousness. When taken home he was put to bed, and during the night did not sleep, but kept talking in a delirious manner, and complaining of pain in the head, oppression of the chest, and general rheumatic pains. Dr. Hidalgo saw him the next day, and found him in a semi-comatose state. The pulse was seventy-five, full and compressible, the temperature normal, and the respiration rather rapid. He was so deaf, that he could only be made to open his eyes by shouting close to his ear. The pupils were contracted. He complained of pain all over, but especially in the head and arms. He had passed three badly smelling liquid stools during the night. He was neither hungry nor thirsty. The electric spark had entered the upper part of the right parietal region, just behind the auricle. The scalp was burned over a surface of several inches, and a spot of dried blood was seen on the upper part of the auricle. The right side of the neck was reddened as by a burn of the first degree; below this, as far as the umbilicus, the effects were equal to those of a burn of the second degree. The electric fluid had passed down the inner aspect of the right leg, producing a burn of the second degree. It had then passed down to the foot, where the burn was of the first degree, and the strip of skin affected much narrower than above. The hat, coat, and trousers were injured — as if torn — along the course of the current, but they were not burnt in any part. The patient was treated with sedatives and some clysters, and in sixteen days was perfectly well. Dr. Hidalgo supposes that the pneumogastric was affected by the shock, which paralyzed respiration, and subsequently the heart's action, similarly to the behavior of an overdose of chloroform. The indication, therefore, was to re-establish respiration; and this was admirably fulfilled by the cold affusion, which, fortunately, was administered quickly, before the paralysis of the heart had become absolute.

THE treatment of keloid by various methods has been so unsatisfactory, that the results of electrolysis in a case reported by Dr. Hardaway, if confirmed, will prove important. In a woman of thirty, after the extirpation of a small nodule of keloid on the chest, a second developed, and attained the size of a quarter-dollar, and was the seat of constant sensations of burning and pain. Hardaway operated on this tumor on several occasions by multiple punctures of the electrolytic needle, now tattooing the surface of the lesion, now burying the needle into its interior in various directions. At the end of several sittings, the patient refused to persevere, because the operation was too painful. Meanwhile the keloid had already commenced to disappear, and the painful symptoms were much relieved, and finally disappeared altogether. Some time afterwards the situation formerly occupied by the keloid was found to be covered by a white pliant cicatrix, hardly elevated above the general surface.

IN cases of pneumonia, etherization, etc., where there is great embarrassment of breathing from accumulation of secretion in the bronchial tubes, great benefit may be derived by inverting the patient, and having him cough while in this position. It is easily accomplished, according to the *Polyclinic*, by a strong assistant standing on the patient's bed, seizing the sick man's ankles, turning him with his face downward, and then lifting his feet four or five feet above the level of the mattress. If the patient, with his face over the edge of the bed, and his legs thus held aloft, will cough vigorously three or four times, he will get rid of much expectoration that exhaustive efforts at coughing failed to dislodge when not aided by gravity. Life has been saved by repeated performances of this maneuvre, in pneumonia accompanied with great cyanosis due to inundation of the bronchial tubes with mucous secretion.

PROFESSOR RUNEBERG some time ago advanced the view that pernicious anæmia may be dependent on the presence of intestinal tape-worm (*Bothriocephalus latus*). His views were supported by some and combatted by others. A case which tends to support Runeberg's view is recorded by Dr. Schapiro in the London *Lancet*. A lad thirteen years of age came under treatment for intense anæmia of a progressive type, characterized by great diminution of red corpuscles and of hæmoglobin, with liability to cutaneous hemorrhage, epistaxis, etc., marked cardio-vascular bruits, pyrexia, and without any emaciation It was not until the administration of anthelmintics had resulted in the evacuation of a large quantity of segments of bothriocephalus, that he began to regain strength and color. His recovery from that date was rapid. The writer attributed the anæmia to the disintegrating action, on blood-corpuscles, of some chemical product of the parasite which was absorbed into the blood.

IT is asserted by Dr. Robert H. Sabin, that gallstones are found only in an acid condition of the system, and that preventive treatment consists in rendering the system alkaline, as indicated by testing the urine. This change is effectually accomplished by administering alkalies.

Himself subject to gallstones, and to his patients similarly afflicted, a teaspoonful of bicarbonate sodium in a tumblerful of water, drank at intervals through the day, corrects the condition of acidity in the system.

DR. LELOIR, in *Jour. de Méd. de Bruxelles*, gives an article on diseases of the skin, occasioned by shock or emotional causes. When following such causes, the progress is usually rapid, and the lesion soon attains its maximum development. The affection is always superficial, scarcely ever involving the deeper part of the skin, and being chiefly of the vaso-motor, catarrhal, or pigmentary sort. Excessive pruritus is a feature of these dermatoses. Their duration is relatively short, and they are especially to be observed in females. Whenever treatment is required, it should be of a character to give tone to the nervous system, and with care to avoid the emotional cause.

IN a case of tetanus neonatorum, in which a Belgian physician had given chloral and other remedies without benefit, he determined to use ether by inhalation In addition to this, artificial respiration was employed from time to time by means of a tube inserted into the nostrils. Some pieces of Rigollot's mustard-leaves were also applied to the chest. The child was laid on its side, according to a suggestion made by Marion Sims. The result of this treatment was, that in a few hours the little patient's condition had improved to a very marked degree. The next day profuse perspiration occurred, and the spasms entirely ceased. Shortly after this the child was convalescent.

TWO cases of uterine colic are reported by Dr. Chouppé to have been successfully treated with antipyrin injections. The first was in the case of a woman who suffered at each menstrual period with very painful colic, which was with difficulty overcome by opium and chloral. Antipyrin in the dose of fifteen grains gave rapid relief. The second was the case of a woman suffering from uterine colic after childbirth. The pains were subdued for five hours by a first injection, and disappeared completely under the influence of a second.

DR. RAMOS, in a Brazilian journal, publishes an article on the "Effect of Quinine on Uterine Hemorrhage," and cites cases in which a very few full doses — fifteen grains — of quinine served to check, and indeed to cure, violent and intractable uterine hemorrhage. In one case iron and ergotine

had been given internally, and cold injections administered without much effect; but a single dose of quinine produced a considerable diminution in the amount of blood lost, and a second similar dose completely arrested the discharge, which did not return.

The following illustration of the practical usefulness of bacteriology is given by the *New-York Medical Record:* An Italian steamer arrived loaded with immigrants. There had been no cholera on board; but as the vessel reached this port, a suspicious case of diarrhœa occurred in a child. The symptoms were not perfectly typical of cholera. Some of the dejections were taken, and sterilized tubes were inoculated, and taken to the Carnegie Laboratory in this city. It would take four days to develop the cultures; and the question arose, whether the steamer should be delayed for that period of time. It was finally decided to do so. The cultures developed in the way characteristic of Asiatic cholera, and the diagnosis was made. Subsequently other cases of cholera appeared, and the culture-diagnosis was abundantly confirmed.

During the last year Dr. Hartamann (*British Medical Journal*) has treated otitis with instillations of several drops of a solution (one in ten) of carbolized glycerine with excellent results. Pain instantly disappeared, and the progress of the affection was checked. In cases where effusion existed, the relief obtained was equally great. M. Rohrer, who confirms M. Hartamann's statements, recommends a solution of twenty per cent.

It is stated, in the *New-York Medical Record*, that Nussbaum claims to quickly cure erysipelas by the use of ichthyol. The erysipelatous surface is first disinfected, and then painted with ointment made of equal proportions of ichthyol and vaseline. The part thus painted is covered with ten per cent salicylic lint, and fixed with a gauze bandage. Next day the border is found to have remained stationary, while the inflamed surface is shrunken into yellowish-brown creases, and is painless. After three days the dressing is discontinued. Five consecutive cases treated on this plan gave equally successful results. Ichthyol collodion is recommended for applications to the face, and ichthyol soap for the scalp.

In the treatment of diabetes, Vigier recommends lithium in pill form: —

℞. — Lithii carbonat . . . . . gr. iss.
Sodii arseniat . . . . . gr. 1–25.
Ext. gentian . . . . . gr. ℈.
For each pill.
Sig. — To be taken morning and night, and continued until sugar has disappeared from the urine.

TEETHING: IS IT A COMMON CAUSE OF DISORDER?

It is the belief of mothers almost universally that most disorders of children are due to teething; this belief is, very unfortunately, too common among physicians. On the contrary, it is the belief almost unanimously of experienced specialists who devote themselves to the treatment of children's diseases, in America and abroad, and whose books are authority with the profession everywhere, that teething is rarely the cause of children's disorders, and, as a rule, the cause of none. The mistake is daily made, by the profession as well as the laity, of allowing the so-called teething disorders to go on without treatment till a stage is reached in which the health, and perhaps the life, is in jeopardy. For example, every mother says of her child's diarrhœa that it is a sort of mysterious vent by which is thrown off a mysterious something that would otherwise "go to the brain," and cause disturbance there; and she not only feels sure that the baby's health is protected by this disorder, but is equally sure, that, without it, other more serious disorders would supervene: so she makes no effort to check it. From the sixth month to the twenty-fourth, loosely speaking, the child is cutting its teeth, so that every ailment that occurs during that period will most likely coincide with symptoms of teething. The physician is, of course, anxious to assign a cause to every disorder; and as he knows the mother's prejudice in favor of teething, and being himself averse to careful physical examination of the child, he yields to the mother's bias, and says the child is teething, therefore the disorder. How often have serious affections been thus overlooked, and the symptoms misinterpreted or altogether ignored!

If a disease is to be considered as a consequence of teething, it must not simply now and then coincide with the cutting of a tooth, but the coincidence should be exact as to time, and repeated, if not with every tooth, at least frequently. We cannot consider any thing the sure cause of an effect, so long as another cause is equally probable. As our knowledge of the causes of disease in children has increased, the importance of teething as a cause has decreased, and we now reject many of the alleged effects of teething that physicians formerly admitted. The chief difficulty arises from ascribing to teething, disorders due to other causes, which might have been easily removed at the outset. — S. A. Russell, M.D., in *Albany Medical Annals.*

AMERICAN PATENT MEDICINES IN GERMANY.

The following official notice was published in the Berlin *Deutsches Togeblatt* of Nov. 17, and gives some interesting information regarding a preparation widely advertised in this country: —

ANNOUNCEMENT.

Under the name of "Warner's Safe Cure," a brown liquid in flat bottles, containing about five hundred grams, has been for some time recommended for kidney complaint, and sold at the price of four marks [$1.00] a bottle.

The official chemical examination of the same, together with the declaration of a Berlin apothecary who introduces it, makes known that its essential ingredient is American wintergreen, and that the bottles are, at the highest valuation, worth only two marks [50 cents] each.

The foregoing is published for the warning of the public.

The Police-President,
Baron von Richthofen.

Berlin, *Nov.* 15, 1887.

IRREGULAR PRACTICE IN GERMANY.

Before the year 1868 the Prussian law prohibited irregular practice by unqualified men. In that year, however, the law was repealed, under the feeling that it was impossible to put down such practice, and that there was a sort of unfairness in having a law of such a nature that a wholesale breach of it was inevitable. Since then, efforts have been repeatedly made by the profession for a return to the former condition of prohibition; but even in the profession itself a wide difference of opinion prevails as to the advisability of such a step. For the purpose of arriving at some kind of concerted action, a joint meeting of members of the Berlin Medical Society and the Central Committee of the eight Medical District Unions was called. Two speakers were selected, one on each side, to discuss the subject. Professor Mendel, as the advocate of those who were opposed to a renewal of the law, opened the discussion in a lengthened address. The champion of the opposing party was Dr. Becker, president of the Central Committee of the Berlin Medical Unions. It is scarcely necessary to follow the discussion; suffice it to say that at the close the following resolution was proposed and put to the vote: "That the renewal of the prohibition of irregular medical practice, by the introduction of a decision to that effect in the German Strafgesetzbuch, is necessary in the interests of the common weal." The resolution was passed by 168 votes against 164, not a very brilliant triumph for the coercionists; or, as Professor Virchow, who is opposed to a renewal of the law, put it, "Das ist nur ein Pyrrhus Sieg!" It is scarcely likely that any action will be taken by the government, when even professional opinion is so evenly divided on the subject. — *Medical Press.*

CHANGES IN THE TEETH.

Dr. B. C. Windle of Dublin, in a paper read before the British Dental Association on "Man's Lost Incisors," reaches the following conclusions: —

1. Man's original dentition included six incisors.
2. Man's lost incisor is the lateral In. 3.
3. This loss is consequent upon the contraction of the anterior part of the jaw.
4. Suppression of the two present lateral incisors is now taking place.
5. Conical teeth are a reversion to the primitive type.

MEDICAL MEMORANDA.

An Anomalous Muscle. — John Hunter pointed out that the sphincter muscles of the eyes differ from other muscles, inasmuch as their natural state, their excited condition, is that of relaxation; for example, the orbicular muscle is in excitement or action during the repose of sleep.

The Indian and Physical Pain. — The general idea that the Indian endures pain stoically, is not sustained by the observations of Dr. Corbusier among the Apaches. He says that "they do not endure physical pain any better, if as well, as the whites. Great or continuous pain renders them stupid, and oftentimes delirious; and the stolidity with which Indians in general are credited is not well maintained by them under small surgical operations, the one of tooth-extracting almost always eliciting a groan or a yell."

Chemical Nature of Vaseline. — C. Engler and M. Boehm have analyzed natural vaseline, a product obtained by simple decoloration of petroleum, or residues of petroleum, with animal black, and then by elimination of the more volatile portions by distillation with superheated steam. The average composition of vaseline is given as 7.10 C., 14.83 H.

A Garbage Crematory. — The garbage crematory at Wheeling, W. Va., is completed, and working. It was recently tested, and a medical gentleman present states that it was entirely odorless. The solid portions remain on the floor of the furnace in the form of a very fine ash. The carcass of a horse left a very small residue of fine calcareous powder, both odorless and tasteless. The gases coming from the burned substances are passed through several very hot chambers before being liberated.

Poisoning by Laburnum Seeds. — One of our medical contemporaries records the case of a number of girls who went into their play-yard after dinner, where they picked up and ate some laburnum seeds. The seeds had been blown over into

the yard from some neighboring laburnum-trees. The nurse in charge, on going into the yard at about three P M., found a girl vomiting; and in the course of a few minutes five other girls commenced to vomit. They were all very white, complained of pain in their heads, and were shivering. At eight P.M. one girl was covered from head to foot with an eruption of large red patches, much resembling scarlatina. All the patients recovered under appropriate treatment.

THE REDUCTION OF COPPER IN FEHLING'S SOLUTION WITH CHLORAL HYDRATE. — On applying Fehling's test to a specimen of urine sent to him for examination, Dr. O. W. Sherwin found the copper reduced as with diabetic urine, while the specific gravity was only 1.015. On inquiry he found that a few grains of chloral hydrate had been added to the urine to prevent decomposition. On further trial he found that a very weak solution of chloral hydrate in clear water would reduce the copper. In two cases, after the internal administration of medicinal doses of chloral, the characteristic reaction was produced on testing the urine with the copper solution. Two days afterwards the urine in neither case showed any signs of sugar.

DEATH OF AN AGED PHYSICIAN. — Dr. Neklewitsch of Loske, in Poland, has lately died at the age of one hundred and nine years, having, a quarter of an hour before his death, seen and prescribed for a patient. Sixteen years ago he had a paralytic stroke affecting both his feet, so that he has since that time been obliged to confine his professional advice to the consulting-room.

HUMORS.

A TEACHER said to a member of the State Board of Health who was investigating the condition of her room, "No, I haven't any ventilators: I don't see any use for them." — "But how do you keep the air pure?" — "Oh, I've got a thermometer."

A COLORED man who had been bitten by a rattlesnake claimed to have been cured by whiskey and an application of raw chicken-flesh. It is hard to tell which had the power to effect a cure, but the colored race and the chicken draw pretty well together.

"To what do you attribute the curative properties of your springs?" asked a visitor at a health resort. "Well," answered the proprietor thoughtfully, "I guess the advertising I've done has had something to do with it."

THE HORSE BLEW FIRST. — A veterinary student, having been sent to administer a dose to a sick horse, was asked by his preceptor what success he met with. "None at all," he replied: "the horse bit me." The preceptor then explained that he should have put the powder into a medicine-tube, and, placing one end in the side of the horse's mouth, blow it into his throat; whereupon the student proceeded to act upon the suggestion. Returning again, he was asked what success he had this time. "None at all," he replied: "the horse blew first!"

THE GIRARD-HOUSE MEDICINE-CUP. — In the Girard House, a large hotel of Philadelphia, there is a white marble ice-water fountain, with a silver cup dangling from a chain. So many people have been taking pills, cod-liver oil, cough-mixtures, and other decoctions, with the help of the silver cup, that the cup got to taste like all the medicines that were mixed in it, and it smelt like a drug-store. Recently another silver cup was chained to the fountain; and over the old one hung a sign which read, "This is the medicine-cup."

Club-List, 1887-88.

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MANAGER.

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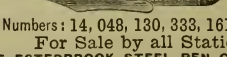

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CONTENTS.

FAMILIAR SCIENCE. — Simple Scientific Experiments 17
Botany as a Recreation 17
Paris Letter 18
The Law of Erectitude 19
A Bit of Coal 20
Scientific Brevities 20

PRACTICAL CHEMISTRY AND THE ARTS. — Simple and Cheap Chemical Apparatus 21
A New Form of Ventilator 21
Starch-Sugar and Glucose 21
A Harmless Red Color for Confectioners and Others 22
Magic Photographs 22
Industrial Memoranda 22
Laboratory Notes 23

HOME, FARM, AND GARDEN. — The Orange 23
A Pheasant Farm 24
Parisian Egg Chocolate 24
Gleanings 24

EDITORIAL. — James Robinson Nichols 25
The Bacon-Shakespeare Lunacy 26
The Senses of Animals 27
Meteorology for December, 1887, with Review of the Year 28
Astronomical Phenomena for February, 1888 28
Do Horses have Sense? 29
Whole Wheat as an Article of Diet 29
Do Worms fall during Showers? 29
Questions and Answers 29
Literary Notes 30

MEDICINE AND PHARMACY. — The Antagonisms of Cocaine. 30
Sanitary Science and Domestic Architecture 30
How to Treat the Eye with a Cinder in it 31
Monthly Summary of Medical Progress 31
Medical Memoranda 31

PUBLISHERS' COLUMN 32

Familiar Science.

SIMPLE SCIENTIFIC EXPERIMENTS.

PLACE the hands over the ears, and pass a piece of string around the head, as shown in the engraving. Then let another person press the string between his fingers, and gradually draw them over it. The vibrations of the string will be transmitted through the hands to

FIG. 1.

the ears, and produce a loud noise resembling thunder. By drawing the nails over the string the sharp claps of thunder are imitated, and by varying the motion the different sorts of rumbling and roaring can be reproduced. The intensity of the sound produced by this simple means is astonishing, and shows how weak are the vibrations that actually affect the ear, even in the case of the loudest noises.

Take a wooden pen-holder with a metal top, and paste a piece of paper upon it so that it covers a part of both the wood and metal. Heat the paper over a spirit-lamp; or an ordinary lamp or gas-flame will answer, if it be held far enough away to avoid smoking the paper. By heating carefully, that part of the paper attached to the wood will become charred, while that against the metal will remain white. The metal, being a good conductor, carries the heat away from the paper; while the wood, being a poor conductor, allows it to remain, and the paper becomes charred.

That sound is due to vibrations, and that a sounding body is a vibrating body, can be proved by a very simple experiment. Take a goblet of thin glass, and attach to the handle a boot-button suspended by a string so that

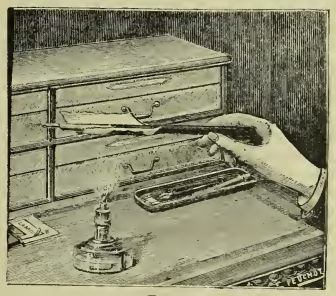


FIG. 2.

the button will rest against the rim. If the goblet is then struck so as to produce a musical sound, the button will be thrown away from its surface, showing that the glass is actually vibrating.

The cuts illustrating the above experiments are reproduced from *La Nature*.

We find in another exchange the following interesting experiment: —

Put a lighted candle behind a bottle, pickle-jar, stove-pipe, or any other object having a polished surface, then station yourself at about twelve inches from the object, so that it hides the flame of the candle from you, and blow with your breath. The candle will be very easily extinguished, in consequence of the currents of air that you have created around the object meeting near the flame. With a board or a sheet of cardboard of the width of the bottle, extinction would be impossible.

This experiment can be varied by taking two bottles instead of one, and placing them alongside of each other, so as to leave a space of half an inch between them. Place the candle opposite this space, and, preserving the same distance as before between your mouth and the candle, blow strongly against the flame. Not only will the latter not be extinguished,

FIG. 3.

but it will incline slightly toward you, as if through the effect of suction. This phenomenon, which is analogous to the preceding, is due to the fact, that, as a portion of the air cannot pass between the bottles, it flows around their exterior, and returns to the operator.

[Original in *Popular Science News*.]

BOTANY AS A RECREATION.

BY FREDERICK LEROY SARGENT.

II.

FOR cultivated plants and our commoner and more easily studied wild ones, we should recommend Gray's *Field, Forest, and Garden Botany*. Gray's *Manual* includes all the wild flowering plants of North-eastern United States, and is the standard for the region it covers. For the Southern States we have Chapman's *Flora*, and for the Rocky-Mountain region Coulter's *Manual:* while for the country beyond there is Rattan's *Popular Flora of California*. The highest authority on the phænogams of North America is Gray's *Synoptical Flora;* but this has not yet been completed, and what there is can be used satisfactorily only after considerable previous study.[1]

In using any of these books, the first thing is, to learn the method of arrangement, and the principles on which the keys are constructed. Sufficient information on this point may be found in the *Lessons* before referred to, and we have only to add a few practical suggestions. In the first place, we would advise that the student begin with plants

[1] As a preparation for this higher work, the student will need to use Gray's *Structural Botany*.

of which he knows the common name. Suppose he has a tulip: he should begin by examining every part of the plant, and describing it in detail; and when he has satisfied himself that he has a clear idea of the form of every organ, he turns to the *Field, Forest, and Garden Botany*, and traces its botanical name by means of the keys. If difficulties are encountered, they will arise, in all probability, either from not understanding certain technical terms, or from a misunderstanding of the structure of some organ of the plant. In the former case the glossary should, of course, be consulted; in the latter case the student may learn just what his mistake has been by finding, through the index, where the plant is described, and then tracing it through the key *backwards*.

It is a very good practice to take a number of plants of which one knows the common names, and compare them with the family, genus, and species, in the description of the book; looking up the definitions of technical terms as far as may be necessary. By this method of *verification*, as it may be called, not only do we have our attention called to hidden beauties that would otherwise escape us, but we gain a familiarity with botanical phrases and the peculiarities of an author, that makes the determination of unknown plants very much easier.

If the student has access to such costly works as Goodale's *Wild Flowers of America* or Emerson's *Trees and Shrubs of Massachusetts*, both of them richly illustrated, he will find that they are admirably calculated to serve for study by the verification method.

It cannot be too strongly urged, that, in all such work, every part of the plant should be carefully examined before recourse is had to the book. Much of the confusion which beginners experience comes from the practice of reversing this rule.

A more serious difficulty springs from the minuteness of many of the parts which a student needs to examine. For the larger sorts of flowers (which a beginner would, of course, naturally start with) a good hand-magnifier and a sharp penknife will bring to view about all that one needs to see; but for the study of small flowers one should have a dissecting microscope, mounted needles, and such skill in the use of them as comes only with practice. In a series of articles published in *Wide Awake* for 1886, the writer has given explicit directions for making a dissecting microscope and the necessary dissecting instruments at small cost, and by means of practical exercises has shown how facility in dissection may be acquired. Given proper tools, the manipulations called for are, in general, exceedingly simple.

In the study of systematic botany it should be the object not only to learn names, and be able to describe the different kinds of plants, but also to appreciate their relationships as shown in their classification into families and higher groups. Let the student begin by learning the primary divisions, and then the distinguishing characteristics of the larger families in each division. Over three-quarters of the flowering plants that we commonly meet are included in about twenty-five large families, and for most of these families the characters are very simple and easily remembered. If special attention is paid to the family characters when plants are studied by verification, it will be found that before long these characters will be impressed on the mind; so that, when a new plant is presented, the student is able very often to tell its family at sight, or at least to tell near what family it belongs in the system. It is no small pleasure to have the satisfaction of thus knowing something of plants that may be entirely new to us; and besides this, we are relieved from using the analytical keys, save in exceptional cases. All this is a very much simpler matter to acquire than will appear at first sight.

The question is often asked, "How can a person remember such a host of names?" All that is needed is, to learn them one at a time, and to have some method of now and then refreshing one's memory.

First as to learning them. It so happens that most of the words we have to deal with are compounded of Latin or Greek roots, and many of these roots are used over and over again, so that a student who learns the meanings of a few of these roots, has a key to the meaning of a good many words. Learning the etymologies is thus one help in fixing the words in the mind. Those who have studied Greek and Latin may have a certain advantage in the matter, but not so great as might seem; for the roots most often used in botanical nomenclature are not the ones which occur most frequently in the classics. All that a student needs to know is how to use a Greek and a Latin dictionary; and once the habit is formed of looking up the etymologies of new words, it will be found that the insight gained will much more than repay for the trouble. It is the habit of botanical writers to give the etymologies of generic names; and so, by paying attention to these, much dictionary work may be saved.

In the second place, we would recommend the practice of keeping a sort of floral diary, in which shall be recorded the name and date of first appearance of all the plants that are met with throughout the year, in walks or botanical excursions. Such lists are valuable in many ways, besides that of keeping the names fresh in the mind. A moment's thought will show how accuracy will be encouraged, and a stimulus given to careful search, and how pleasant reminiscences will be called to mind in looking over the lists of former years.

Although the suggestions which we have so far offered have been applied especially to the study of flowering plants, many of them are, of course, equally applicable to work on the lower groups. A few additional suggestions regarding these other departments of the subject may now be given to complete our consideration of systematic botany.

There are two principal sources of difficulty which render the cryptogams or flowerless plants, as a rule, harder to study than the plants we have been considering. These are, (1) the extreme minuteness of the parts to be examined, necessitating the use of a compound microscope; and (2) the more or less confusing and highly technical character of much of the literature that one is forced to use. Still, it must not be supposed that all the flowerless plants are equally hard to study, any more than we should say the same of flowering plants. On the contrary, there are certain groups of cryptogams which may be studied almost if not quite as easily as any of the phænogams.

The ferns are a case in point, for to any one who has gained a moderate degree of proficiency in the determination of our wild flowers the study of ferns should present a field as easy as it is delightful. It may be invidious to single out a group for special admiration, since each has a charm of its own; but it is difficult not to grow enthusiastic over ferns. As Thoreau says, it seems as if "nature made ferns for pure leaves, to show what she could do in that line." On account of their extreme beauty, there has been developed a very full and valuable literature concerning them. In the books before referred to, the ferns of the region are included, and in Gray's *Manual* the student will find their study greatly facilitated by the admirable plates illustrating the generic characters. For works covering the whole region of North America we have Underwood's *Our Native Ferns and their Allies*, in which an introductory part gives all the information that a beginner would need regarding the best ways of studying the group; and Eaton's *Ferns of North America*, a most magnificent work, containing colored plates of all our species. In Hooker's *Synopsis Filicum* all species throughout the world are described so far as known, and the characteristics of the genera and sub-genera are well illustrated by several plates.

Whereas in the ferns and their allies a good dissecting microscope is all the optical apparatus that a student needs for the determination of species, in the mosses and liverworts a compound microscope, magnifying from about one hundred to three hundred diameters, is necessary if one would determine more than the characters of certain genera. There have been a number of books written on the use of the microscope; and if one must work without a teacher, some of these will need to be consulted. Phin's *How to Use the Microscope* is a small book, but thoroughly practical. Behren's *Microscope in Botany* is more recent and more elaborate, and may be recommended to those who wish to go rather deeply into the subject.

For those who do not own a microscope, but who would like to learn to recognize the commoner and more easily distinguished genera and orders, the writer has prepared a short *Guide to Cryptogams* that may prove of service.

Our present authority on the mosses of North America is the work of Lesquereux and James. In this the principal genera are illustrated by several excellent plates, and the technical terms are defined in a glossary. The key to genera is, however, very unsatisfactory, and the student will do well to use a key recently prepared by Professor Barnes.

Underwood's *Hepaticæ of North America* is our most recent work on liverworts. There are no illustrations in this book, but in the old edition of Gray's *Manual* (1863) the student will find the genera fully illustrated.

[Special correspondence of the *Popular Science News*.]

PARIS LETTER.

FOR some time hypnotism has been the current topic of scientific talk in many Paris circles. The readers of the *Popular Science News* have certainly heard a good deal about hypnotism; but so many misstatements and misrepresentations have been made, that many points require a supplementary information.

When a proper subject is hypnotized by either of the classical methods, he is made to pass first into a condition of lethargy, during which he is insensible to all exterior facts. This period is specially noticeable on account of the ease with which muscular contraction is induced in any part of the body at will, by means of a very slight friction of the skin. The subject, in a cataleptical state, is easily brought to a second condition by very simple means, such as a slight touch on the forehead. During this state the subject opens the eyes, and his senses may perform their functions. The whole body, or any part of it, preserves during a long time (fifteen to twenty-five minutes) all positions that are given to it, however abnormal and tiresome they may be. The subject moves about, but without much spontaneity. When pictures are shown to him, his face assumes gradually an expression which corresponds with the nature of the picture which is shown, — a sad face corresponding with a sad subject, and a merry one with a merry representation. During this whole period the eyes are very intently kept upon the objects which they are brought to bear upon; and when a forcible attempt is made to hide them, without furnishing at the

same time some other matter of contemplation, the subject seeks, even violently, to see it again. Such is the case especially when the subject has been made to gaze upon a human face, and when the possessor of the face conceals his own eyes behind some book or other sort of screen. No speaking occurs during this period.

The third period is that of lucid somnambulism. The subject is awake, hears and speaks, goes about, reasons, etc , but is not at all aware of the abnormal state he is in. The most important feature of this period is an extraordinary credulity. If the patient is told, in a room numbering as many gentlemen as ladies, that not a single gentleman is present, he believes it, after some resistance, and says he does not see a single one. He may be also told that there is not a person in the room, and believe it; that he is in the centre of a splendid garden, in a theatre, in a valley, in a church, and believe it after a time. He describes all he sees in imagination. When he is told that, for instance, he is going to be married to any of the persons present at the experiment, a quite amusing scene ensues; and the result is the same when he has been told that he is this or that, — a soldier, a merchant, an artist, etc.: he plays the part, displaying the features which to him are the most striking. If he is told to do any particular thing, he does it after more or less resistance; the most curious thing is, that, if he is told repeatedly that he has done or witnessed any given deed, even of the most cruel sort, and the most prejudicial to himself, and at the same time that he *must* remember it when awake, and go and tell about it to any given person or official, he obeys. M. Bernheim, in Nancy, has caused in this manner a hypnotized subject to go and accuse a given person of some atrocious murder, which he said he had witnessed, giving all the details and particulars of the case, and the most circumstantial evidence; he also caused another subject to go to a police station and deliver himself up to the master, confessing his guilt of a crime he pretended having committed in such and such circumstances. A curious feature is, that if the subject is told, when in a hypnotic condition, to do such and such a thing at such and such a time of a given day, he does it at the ordered time, impulsively, without knowing why, after feeling an uncontrollable impulse to do it. For instance, M. C. Richet told a subject that she was to come and visit him a few days later at three o'clock. The very day, at the very hour, the lady came in a hurry to M. Richet, saying, "I do not know why I came, but I wanted to see you; I felt I must come." She had left his parlor full of visitors, and had come directly.

Since it is possible to influence hypnotized persons to such a degree, it is easy to infer that this method may be used for very bad as well as for very good purposes. A person familiar with hypnotism may cause any subject to go and kill any one he chooses, in any manner, or to perpetrate any other criminal deed. On the other hand, a hypnotized person may be told to act in such and such a manner, kindly and virtuously, and his moral character may be in a great measure bettered, as M. Voisin of Paris has shown.

Another very curious fact concerning hypnotism is that discovered by MM. Burot and Bourru of Rochefort, — that different drugs or poisons, when held in stoppered vials behind the neck of the patient, do, after some minutes, exert very curious influences. I recently went to one of M. Luys's lectures on the subject, and witnessed very strange things. The patient being seated in a large armchair, one out of a number of glass vials containing different drugs and poisons was inserted between her neck and dress. After some time different symptoms came on. The first vial used contained alcohol. After a few minutes she was dead drunk, rolling about, with fearful vomiting efforts. The vial was taken off, and after some time peace was restored. Then a valerian vial was used. This drug exerts a singular effect: the patient begins scratching the earth, and believes it is picking some deceased relative's bones. Water provokes hydrophobic symptoms, etc.

These experiments are certainly very curious, but I must say that they are performed in such a careless and unscientific manner, that I can have no confidence whatever in the results. Dr. Luys, who has repeated them for a year or two in Paris, is certainly a very honest and scrupulous man, but as a scientist he does not sufficiently perceive the difficulties of experimenting, and allows himself to be deceived by unscrupulous patients. It is my opinion, and I find that it is also a very general one.

The other great topic of the day is overwork, — over-pressure, mental as well as physical, but especially mental. Physical overwork is not exactly scarce in France, but, in fact, it is not really overwork: it is rather an absence of equilibrium between receipts and expenses, the French workman being a very active and energetic man so long as politicians have not disturbed him from his every-day work, but being too often also an ill-fed man, especially in towns where meat is too dear, and unhealthy alcohols too cheap. The absence of equilibrium between the fuel given to the human engine and the work it is made to give, is what makes overwork; but in the case of the Frenchman more work could be got, or, at any rate, the same amount could be had without injury, if his nourishment was better. The real overwork in France is the mental one. All men living in towns, and having to work for their living, belonging to liberal professions, are more or less overworked. This is especially true of young men preparing for government schools, examinations, and competitions. The amount of knowledge required is a very great one, and one which presses too much upon the memory. This, added to the fact that in many professions examinations and competitions are going on from eighteen to thirty or thirty-five, is a great inconvenience to personal and original work. In the medical school, for instance, after graduation for the diplomas of Bachelor *in lettres* and *in sciences*, the candidate is subjected to a series of examinations, coming on every six, twelve, or eighteen months, by which the Faculty ascertain whether he has profited by the courses. Very well: this is quite logical and necessary. But then, if the student wishes to emerge from the *vulgum pecus*, he has to compete for the *externat* and *internat* of hospitals (two at least, and generally three or four competitions), for official positions in the medical school, such as *Aide d'Anatomie*, *Prosecteur*, Fellow of the Faculty, or Physician to the Hospitals. When a man, wishing to be among the first of his professiou, has achieved all this at thirty, it is quite an exception. Thirty-five is the average age, and forty is uot uncommon at all. But the great inconvenience of the process is, that, examinations and competitions requiring only memory, most of these successful men are quite unprepared for original work and thought. Why should they have cultivated this part of their mind? It is not required for examinations, so they do not concern themselves with it; and geuerally, when a man has never tried to do any such work, it is not at thirty-five or forty that he begins to do it. The consequence is, that the Fellows of the Faculty and the physicians of the hospitals are generally very learned men, but are quite unable to hold any high post in professorship, owing to their lack of personal investigation, or, when they hold them, they do so in a very imperfect manner. The medical schools are suffering in a high degree from this cause, and it tells cruelly upon the scientific value of the teaching body. An attempt is being made at present to dispel this situation; and in the future competitions for Fellowships, the memory part will be less developed, and original work will be called for. This is very well, but the method ought to be applied to the whole series of competitions: this must be the beginning; and we much fear that it is not so, the old routine-process being so very much impressed in the minds of the whole Faculty. This difficulty in getting original workers is the result of overwork during many years, which incapacitates men for original thought, from its long standing, and the epoch of life at which it is required.

Overwork is not less frequent in preparing for government schools, especially for the *École Polytechnique*, where so much is required — from the memory stand-point — from successful candidates, and whence so little proceeds as concerns original work.

Overwork is the common ailment of all young ladies preparing for competition for official positions in the way of teaching; and what is worse is, that there are not positions enough to give them. Thousands of these overworked, ill-fed girls are waiting for appointments which they will never get

The overwork system is the prevailing one in France; and its effects are all the worse because, if mental hygiene is decidedly overlooked, it is even more the case with physical exercise and hygiene. Bodily exercises are not enough attended to in educational establishments, and this cause adds to the dangerous consequences of mental straining.

At a recent meeting of the Biological Society it was shown that the air exhaled by tuberculous patients, for instauce, does not contain any microbes, and that the breath probably plays no part in the contagion of infectious diseases. At the same time, but by other persons, it has been shown that the air expelled from the healthy human lung contains peculiar matters that are certainly poisonous (the carbonic acid being iucluded, of course), and that are given up by the lung itself.

The great physiologist Haller had already expressed the idea that such matters do exist.

Two observers, a French and an Austrian one, have recently shown the curious effect exerted upon the acuteness of any given sense by the simultaneous exercise of any other one. They show, for instance, that hearing is improved by light, especially red or yellow, and that this action is a reciprocal one, and is exerted on every sense by all others. The results are very curious aud interesting.

H.

Paris, *Dec.* 22, 1887.

[Original in *Popular Science News.*]

THE LAW OF ERECTITUDE.

BY DR. S. F. LANDREY.

The curiosity of travellers and the wonder of reading world have often been excited by the remarkable Leaning Tower of Pisa. In our common schools where physiology is taught, the young people will recollect the explanation given by teachers of round shoulders, and the cause of a stooping figure, as resulting from, 1st, a pressure on the anterior portions of the inter-vertebral cartilages; 2d, partial absorption of the same by a continuance of the pressure till the position becomes habitual or confirmed. For the present the above two suggestions will be sufficient, if the reader is in a thinking mood, to furnish food for a week's reflection.

Nature undoubtedly designed the normally erect attitude to be attained by every perfect human being; i.e., from a physical stand-point. Bad positions in nursing children, and, during childhood, the permitting of crooked, unhealthy, and ungraceful positions, on imperfect benches or forms, and at different kinds of labor, settles the question for them in after-life of an ungraceful, consumptive figure, and heads bowed down in sorrow. Let them early be taught the necessity of proper positions at all kinds of work and under all circumstances, and fewer crooked, ungainly forms will be seen. I remember very well two men in one of my former dwelling-places who were singularly marked by their respective avocations. Both had a drooping right shoulder, caused by their respective pursuits. One was a tinner; working his shears on a low bench caused his shoulder to droop: while the other was a saloon keeper; bending his form, with the right arm under the counter, rinsing glasses, and reaching for bottles, marked him in the same way. Both, when walking the streets, exhibited a similar droop of the right shoulder, but from very different causes. Another man had smoked cigars till quite a respectable hole was left in the right-hand side of his lips, from the pressure of the cigars while smoking. That sign he will carry to his grave, for the lips have been permanently moulded to the figure. Injudicious and ambitious parents have caused many a case of bow-legs by permitting baby to stand up and bear his weight on his pretty little cartilaginous bones before they were strong enough to bear the load without bending. A great many partially lop-sided heads are produced by too often or too long nursing on a single arm, or by letting baby sleep on the left or right arm almost wholly, to the exclusion of the other. Very young children, too, have been distorted for life by being permitted or forced to bear burdens beyond their ability to carry, or compelled to bend over in an unhealthy position, at writing, wood-sawing, etc., till irreparably deformed.

But to return to the Tower of Pisa. A less settled condition of the soil or an inadvertent building of the foundation, with a slightly lower incline on the defective side, was, perhaps, the cause of the after-defective position; nor have we forgotten that some writers contend that it was purposely inclined to its present angle while in process of erection, but common sense never would permit us to believe this part of its history. In the plant kingdom are many towers of Pisa, and we will give an example of this law of erectitude as applied to plants.

Here on the side-hill, river-bank, or on the plateau, where existed a merely slight depression, grows a tree whose radicle and plumule, in order to preserve the line of erectitude, or, more properly, to grow with its axis in the direct line of gravity, has had to yield to the influence of a slightly disturbing cause on one side of its growth. The primary effort at putting forth was unchecked; but as it reached the light and air, and had started at an angle from the resting-place of the seed, there must needs be some compensative force to overcome this lack of early erectitude. Now look again at the maturing plant or tree. From this lower side it bends toward the opposite or rising side of earth; and to accommodate the tree or plant to its first position, it becomes convex on the lower side of its trunk for some distance above the collet, — perhaps two to four feet, or even more. In some cases several compensating truncal curves succeed each other in opposite directions, till the bulk of the top is directly placed over the line of gravity or erectitude. Probably a large and extended limb has been thrown above, to compensate for the antagonistic curve in the base of the trunk. Now apply what has been gained by a few observations of this kind to a large scope of timber, and note your surprise in not finding a perfectly straight tree, — without any variation from its initial point of growth. It is true of men as of trees, — *more are crooked than straight.* To find a perfectly erect man or tree is oftener an exception than a rule. In the case of some elms, sycamores, etc., it is often a matter of astonishment how nature will throw out on one side an immense pilaster or buttress of root and trunk, to compensate for a defective leaning or want of growth on the opposite side. Often an instructive lesson can be gleaned by observing that nature sometimes so arranges the bulk of a dissolving or soluble axis as to perfectly accommodate the basal curvature and early lack of erectitude.

A BIT OF COAL.

In the course of a lecture given at Toynbee Hall, a charitable institution founded for the benefit of the poor inhabitants of the "East End" of London, Professor Boyd Dawkins, speaking of "a bit of coal," said that, besides the element of carbon, coal had another important constituent in the form of a resinous substance visible in shining patches on any cross-section. To this element, which was composed of the spores of plants allied in nature to the club-mosses of the present day, were due all the blazing properties of the coal; and the extra quantity of gas existing in cannel coal was due to the fact that it possessed a greater proportion of the resinous component. From an examination of a piece of coal it was possible to picture the vegetation of the carboniferous period; and the forests from which the coal-fields were accumulated must be imagined as consisting largely of trees closely akin to club-mosses, but immensely greater in growth, of other kinds of coniferous trees, and of enormous ferns. Every seam of coal was found to rest upon a bed of some other substance, generally shale, traversed in all directions by the roots of plants. This substratum was clearly, therefore, the soil on which the coal-plants grew, for all these roots could be identified with the stems of the plants found in the overlying strata. Upon a seam of coal there generally was found to rest a bed of shale or sandstone, which was nothing more than a petrified mud-bank or sand-bank, and in either case must have been accumulated by the action of water. The coal-seams were, therefore, at one time covered with water, the inundation being accounted for by the dropping from time to time of the surface of growth. Of the time required for the accumulation of any one coal-seam, the geologist could say absolutely nothing. It was a noticeable fact that the coal-fields of this country existed as a series of isolated basins. How was this to be accounted for? Taking a section of the strata from Manchester to Derby, it was found that at the Pennine range the stretch of coal-measure rocks was interrupted by the intrusion of the lower strata, but resumed on the other side of the mountain chain. As for every seam of coal occurring on one side of the hills there was found an equivalent on the other side, it was to be concluded that the coal-seams had been at one time continuous. Convulsions had taken place in clearly defined lines, and one of them could be traced through the south of Ireland and Wales towards the south-east of England. From this fact Professor Dawkins said that he had no doubt that basins of coal-producing rocks were to be found in the last-mentioned area; and, in fact, an experimental search for one of them was at that time proceeding at Dover. — *English Mechanic.*

SCIENTIFIC BREVITIES.

A STEEL BIRD'S-NEST. — Near the town of Soleure, in Switzerland, a bird's-nest was recently found which was constructed entirely of the imperfect watch-springs thrown out from the workshops. It has been deposited in the local museum.

THE NEAREST STAR. — The distances of the stars are ascertained in the same manner as those of the sun and planets; that is, by parallax. Instead, however, of taking two stations at different parts of the earth's surface, and laying down a base line between them, we take the diameter of the earth's orbit, or 183,000,000 miles, as the base; the observations being taken at intervals of six months. Even with this immense line, however, the parallax is so small that it can only be detected by the most careful observations and accurate instruments. The parallax of about a dozen stars has now been ascertained, and is found to vary between 0.919 sec. and 0.046 sec. The star α Centauri is the nearest to the earth, and its distance is estimated at 20,496,000,000 miles; while the average distance of stars of the first magnitude is probably three or four times as great as this.

A NORTH-CAROLINA DIAMOND. — Mr. G. F. Kunz states that a diamond weighing $4\frac{1}{2}$ carats or 873 milligrams was found on the Alfred Bright farm in Dysartville, McDowell County, N.C., in the summer of 1886. It is quite perfect, but not pure white, having a faint grayish-green tint. In form it is a distorted hexoctahedron, with partial twinning. Its specific gravity is 3.549, and it measures ten millimeters in length and seven millimeters in width. None of the minerals ordinarily associated with the diamond were found at the locality, and the opinion is expressed that the diamond must therefore have been transported from distant higher ground in the vicinity during a heavy freshet.

VARIETIES OF COKE. — The difference of result obtained by heating organic structures from ordinary to high temperature, rapidly or slowly, to expel volatilizable parts, is well shown in the difference in the structure of cokes produced from ordinary bituminous coals in gas retorts, and that from the same coal in coke ovens. Gas coke, which is made by rapidly heating the coal, is in the form of a spongy, porous mass, weak in structure, insonorous, easily ignited, and having the appearance of a mass from which bubbles of gaseous matters have escaped. Oven coke, which is made by heating comparatively large bodies of coal gradually and continuously for a long period, is of a close-grained structure, capable of sustaining great pressure or weight, and so compact and dense that it is sonorous. This coke is far more difficult to ignite than the gas coke.

ON THE BEHAVIOR OF PHOSPHORUS, ARSENIC, AND ANTIMONY AT A WHITE HEAT. — Mensching and Victor Meyer have obtained evidence that phosphorus and arsenic suffer a marked loss of vapor density at a red heat, and that at a white heat they approximate the values P_2 and As_2, although the densities corresponding to these molecules have not yet been observed. With regard to antimony, the authors have succeeded in determining its hitherto unknown vapor density, using a porcelain vessel. This element behaves in an entirely different way from phosphorus and arsenic, no molecular weight corresponding to the formula Sb_4 existing. On passing into the state of vapor, which it does with difficulty, it assumes at once a molecular condition represented by a formula smaller than Sb_4, and also than Sb_2; so that its actual molecular size is either Sb_2 or Sb_1, but which of these has not yet been determined, owing to the difficulties of obtaining a normal antimony vapor having an invariable expansion-coefficient at this high temperature.

Practical Chemistry and the Arts.

SIMPLE AND CHEAP CHEMICAL APPARATUS.

In the June number of this journal a water-pump for producing a vacuum for filtering-purposes was described and illustrated. It was to be made of brass or other metal, and could only be constructed by a practical brass-worker. Mr. Robert Law, in the *Chemical News*, describes a simple form of this apparatus, which can be made by any chemist from pieces of ordinary glass tubing. It is constructed as follows: Select a piece of stout glass tubing 3 inches long and $\frac{5}{8}$ inch bore; fit this with corks, — one with two holes, the other with one hole. Now take three pieces of ordinary glass tubing $\frac{1}{16}$ inch bore, and draw two of them out, as shown in Fig. 1. Cut the one at *a* and the other at *b;* bend the third piece at an angle of 90°. Insert *xa* and the bent piece through one cork, and *xb* through the other, so that *xa* will project inside of *xb*. Attach *xa* to a water-supply. On allowing water to run through the apparatus, a vacuum will be caused in the tube *N;* and, if connected as shown in sketch, the process of filtration will be greatly facilitated. This apparatus has given a vacuum as high as 28.5 inches of mercury.

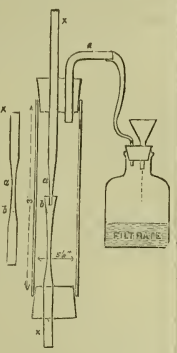


Fig. 1.

Mr. H. N. Warren, in the same journal, describes a simple apparatus for preparing large quantities of sulphurous-acid gas. It consists of a glass vessel, *A*, provided with three tubulars, otherwise resembling a large Wolff bottle; the large tube *B* being provided with a stopper for the purpose of introducing pieces of sulphur from time to time into the small dish, *C*, intended for its reception, and fed with air by means of the delivery tube, *D*, thus allowing the stream of gas caused by the consumption of the sulphur to escape by means of the exit tube, *E*, to the vessel desired to receive it.

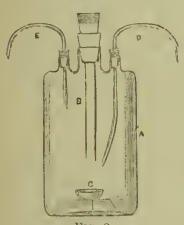


Fig. 2.

In using the apparatus, the sulphur is first kindled by introducing a red-hot wire through the tube *B*, and replacing the stopper that has been momentarily removed for the introduction of the same. A slight blast is now maintained from the bellows that are in connection with the pipe *D*, until the whole of the sulphur is thoroughly kindled, when a somewhat more powerful blast may be applied. By substituting phosphorus or carbon for the sulphur, phosphoric anhydride or carbonic dioxide can also be made in any desired quantity.

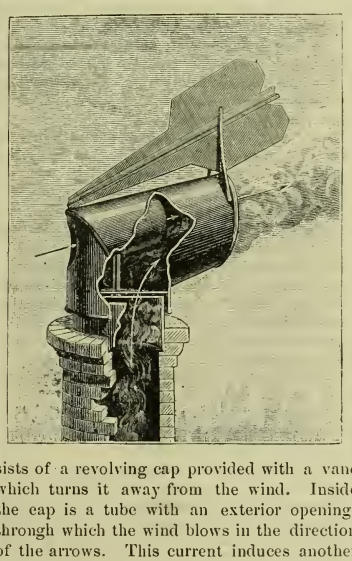
The *Journal of Analytical Chemistry* also describes a form of the well-known Liebig

Fig. 3.

condenser, which has the advantage of simplicity and considerable flexibility. As will be seen from the illustration, it consists of two plain glass tubes, connected together by a piece of stout rubber tubing, *b*. Through a hole in this a small piece of glass tubing, with a shoulder fused at the inner end, is pushed, which serves for the passage of water.

A NEW FORM OF VENTILATOR.

This novel form of ventilator is the invention of M. Becker, and is described in *La Nature*. It is constructed on the same principle as the steam-injector, so universally used for feeding water into steam-boilers. It consists of a revolving cap provided with a vane which turns it away from the wind. Inside the cap is a tube with an exterior opening, through which the wind blows in the direction of the arrows. This current induces another current in an upward direction through the chimney, just as the jet of steam passing through an injector carries along with it a stream of water. A more familiar illustration of the same principle is seen in the common perfume atomizer, in which a current of air, passing across the top of a tube dipping into the perfume, draws the liquid up through the tube, and blows it into a fine spray.



As this form of ventilator is not dependent upon a current of heated air from the fire, it is also applicable to the ventilation of closed chambers, vaults, and similar places where offensive or dangerous gases are present. The principal disadvantage is, that it does not operate in calm weather; but there are only a very few days when there is not sufficient wind to cause more or less air to pass through it.

[Original in *Popular Science News.*]

STARCH-SUGAR AND GLUCOSE.

BY GEORGE W. ROLFE, A.M.

As long ago as 1811, Kirchoff, a Russian chemist, noticed that starch, when boiled with dilute acids, was transformed into a sweet substance resembling ordinary sugar. Indeed, Kirchoff supposed it to be identical with the sugar of the sugar-cane.

The French took great interest in this discovery of Kirchoff; for France at that time had entered into the long and bloody wars of the first Napoleon, and was cut off from her sugar-supplies by the blockade. Starch, however, being plenty in their country, the French at once with the greatest enthusiasm began the manufacture of this new sugar, which seemed to present no difficulties. But they soon found that their product was radically different from cane-sugar. By no method could the soft, waxy substance be converted into the hard, shining crystals so characteristic of the sugar brought from America and India; besides, the starch sugar had much less sweetening power, and consequently made but a poor substitute.

The French spent much time and ingenuity in vain attempts to make cane-sugar out of the new sweet, but finally gave it up, for after the war, cane-sugar again became plentiful, and so there was no stimulus for further effort in this direction.

Although for over fifty years starch-sugar has been put to but little practical use, except in a small way in the manufacture of beer, and as an adulterant of the poorer grades of cane-sugar, yet to the scientific world it has proved of the greatest interest. It has been found to occur widely in the vegetable kingdom, being the natural sweet of most fruits: hence its popular name, "grape-sugar."

Investigations into the chemical nature of this substance led to the discovery of many other sugars, till at present at least fifteen distinct sugars are known. All of these can be ranked into two distinct classes, — the *glucoses* of general chemical formula $C_6H_{12}O_6$; and the *saccharoses*, $C_{12}H_{22}O_{11}$.

Starch-sugar is a *glucose*, while cane-sugar belongs to the latter class.

Boiling with dilute acids converts a saccharose into a glucose; but unfortunately, as our French friends found, no art of the chemist has as yet been able to convert a glucose back to a saccharose. All housekeepers who have had occasion to put up fruit preserves have doubtless noticed the mysterious loss of sweetening power in cane-sugar caused by this *inversion*, as it is called; the cane-sugar being transformed into two glucoses of inferior sweetening power, — starch-sugar, or *dextrose* as it sometimes called, and *lævulose*.

$$\underset{\text{Cane-sugar}}{C_{12}H_{22}O_{11}} + \underset{\text{water.}}{H_2O} = \underset{\text{Dextrose}}{C_6H_{12}O_6} + \underset{\text{lævulose.}}{C_6H_{12}O_6}$$

The acid does not enter into combination with the sugar in this reaction.

Starch-sugar plays an important part in the digestive and circulatory functions. Every particle of starch eaten must be converted into this glucose by the digestive fluids before it can be utilized by the blood. This sugar is also produced in the liver in considerable quantities.

While the pure starch-sugar has but a limited practical application, a sirup containing starch-sugar has of late years become of great commercial value. This article, known in trade as *glucose*, depends on the following chemical principles for its manufacture: —

When starch is boiled with dilute acids, it is not converted directly into starch-sugar, but a gummy substance called *dextrine*, and a saccharose sugar known as *maltose*, are first formed. These compounds, on further boiling, are transformed into starch-sugar. If the "conversion" of the starch is stopped before all the maltose and dextrine have disappeared, we have a sweet, gummy sirup, containing all three, — dextrine, maltose, and starch-sugar. This sirup is the "glucose" of commerce, and is manufactured as follows: The starch, obtained usually from Indian corn by the ordinary methods, is mixed with a small percentage of acid, and boiled by steam-heat, either in open tubs or under pressure, till a sirup is formed containing the right proportion of starch-sugar. To stop the boiling at the right point is a matter of the greatest delicacy; the object being, to have the sirup sweet, and yet not liable to solidify from excess of starch-sugar. The acid sirup is then neutralized with some suitable base, filtered to remove impurities, mechanically suspended, decolorized by passing over bone-black, and concentrated to a thick, viscid liquid.

Simple as these processes seem, the successful manufacturing of glucose is a matter requiring the greatest nicety of detail. The product is practically colorless, perfectly transparent, neutral, and contains only about two-tenths of one per cent of foreign salts. The finest grades of glucose are used by confectioners; ordinary candies containing thirty to ninety per cent, and the cheaper kind of gum-drops being practically pure glucose.

Glucose, being a colorless neutral sweet in a state of almost absolute purity, is excellently adapted for use in the manufacture of soda-water, sirups, jellies, and similar products. It is extensively mixed with cane-sugar sirups, but can hardly be considered an adulterant in the ordinary acceptance of the term, as its cost per gallon is much more than that of cane-sugar sirup.

In spite of the fact that the components of commercial glucose — dextrine, maltose, and starch-sugar — enter into so many natural food-products, starch-sugar also playing such an important part in the digestive functions, this product has been condemned by many as unwholesome and even poisonous.

This idea has arisen from the fact that in the manufacture of glucose strong mineral acids are used.

It is generally known that such acids in a concentrated state, when taken into the system, quickly produce death. The popular mind, possessed of the one fact that mineral acids are used in this process, but ignorant of the details, immediately jumped at the conclusion that glucose was necessarily poisonous, and should be condemned as an article of food.

Now, the facts of the case are these: —

I. The acid used does not combine chemically with either starch or glucose, but in some unexplained way, by its presence acting in concert with the water and heat, produces the change in the starch, so that at the end of the process there is just as much free acid as in the beginning.

II. The amount of acid is exceedingly small, — a few pounds dissolved in many hundreds of gallons of water sufficing the purpose

III. This acid is exactly neutralized with some basic substance, — soda, lime, or potash, — forming such harmless salts as calcic sulphate (gypsum), sodic sulphate (Glauber's-salts), or sodic chloride (common salt).

IV. These salts are never present in more than two or three tenths of one per cent, — often in no greater quantity than in some hard waters, — and their presence can only be proved by delicate chemical tests.

Few food-products, therefore, can boast of the remarkable purity of commercial glucose.

There are eight glucose establishments in the United States, having a capacity to consume about twelve millions of bushels of corn annually, and making over three hundred and sixty million pounds of glucose.

This immense industry has sprung into existence within the last dozen years.

A HARMLESS RED COLOR FOR CONFECTIONERS AND OTHERS.

GAWALOVSKI recommends, as a harmless red color for confectionery and all sorts of eatables, the extract of the red flower of the poppy (*Papaver rhœas*). This plant, which grows everywhere throughout Europe, produces in June or July the well-known flower in abundance, the leaves of which, when dried, yield, besides about twelve per cent fat, twenty per cent gum and twenty-eight per cent vegetable fibre; also about forty per cent of red dye, which is the basis of *syrupus rhœados* (German pharmacopeia). This substance may be used as it is, or the pure color may be extracted from the fresh-gathered leaves, by putting them in a clean bottle, pouring sulphuric ether on them, and allowing the bottle to remain well corked and undisturbed for about two hours in a cool place. The ether, which may serve twice or three times for the same operation with fresh leaves, is then poured off, and undiluted alcohol poured over the leaves. After three or four hours the entire coloring matter of the poppy-flower has been extracted, and is contained in the alcohol, and may be used either as it is, in the alcoholic solution, or after having been evaporated and re-dissolved in water containing sugar (sirup).

This red dye has the following qualities in relation to solutions and tests, according to the experiments of Gawalovski: —

1. It is unsoluble in ether (ethylether), benzoate of chloroform, and amyl alcohol.

2. It is soluble in water, spirits of wine, and methylated spirits, turning to a light-red color.

3. Metallic acids and organic acids turn the solutions named in 1 and 2 a bright red, except nitric acid, which, when cold and diluted, turns the color gradually, but when hot, and in any degree of concentration, changes the color into yellow, and destroys it altogether.

4. A solution of alum dyes it bright red; a solution of soda precipitates a violet powder.

5. Caustic soda and potash turn the color a brown red, which can be neutralized by diluted mineral acids and organic acids.

Gawalovski concludes his report to the German "spirit industry" with the remark that this is a very innocuous color, easy distinguishable from tar colors, and highly useful and satisfactory to those who have to color articles of food. — *Practical Confectioner.*

MAGIC PHOTOGRAPHS.

THE following is taken from the *Druggists' Circular:* "This name is given to a new sort of photographic prints now sold in Paris. When sold the paper is perfectly white, and the image appears on dipping the pasteboard in water. The photographs in question are obtained as follows: —

"With any desired negative a proof is printed on ordinary chloride-of-silver paper, such as can be procured from all dealers in photographic materials The positive is next fixed with a bath containing ten per cent of hyposulphite of sodium. The print must not be toned with gold, but most carefully washed with water, so as to leave in the paper no trace of hyposulphite. This is absolutely necessary for the production of an invisible image.

"The print is now placed in a bath composed as follows: —

Take of

Bichloride of mercury	5 gm.
Water	100 "

"The image there gradually fades away, and finally disappears altogether. The paper, having been thoroughly washed a second time, is dried, and the photograph is ready to be mounted. In mounting the photograph, a small piece of blotting-paper impregnated with hyposulphite or sulphite of sodium is posted between the albumen paper and the pasteboard, or behind the pasteboard, so that, on being dipped in water, the sulphite dissolves, and develops the image.

"The following is the explanation of the chemical changes which take place: The first image, obtained from the usual printing with a negative, owes its color to reduced silver. On contact with the corrosive-sublimate solution, chloride of silver and calomel are formed, both of which are colorless, but turn black in presence of sulphites or hyposulphites. The final image owes, therefore, its color to sulphide of mercury, with probably sulphide of silver."

The bichloride of mercury must be used with care, as it is highly poisonous when swallowed.

INDUSTRIAL MEMORANDA.

THE "TIMES" OF INDIA contains a description of a remarkable engineering undertaking at Gokak, where three turbines, each two hundred and fifty horse power, transmit power by rope gearing to a cotton-mill at a distance of seven hundred and thirty-nine feet, the first three hundred feet being up the face of a perpendicular cliff. The work appears to have been carried out in an especially skilful manner.

A CABLING FEAT. — A remarkable feat of cabling matter has been accomplished by the *New York Times*, which published, on Nov. 18, the whole of Mr. Swinburne's new tragedy, *Locrine*, forwarded by its London correspondent. The tragedy filled two nonpareil pages — fourteen columns — of the paper, and formed a "cablegram" of 18,000 words. We learn that part of this — 10,000 words — came over the Commercial Cable Company's lines, and the remaining part was transmitted by the Western Union The portions handled by the Commercial cable covered 1,050 feet of paper tape. The cablegram was taken at the rate of nearly 17 words per minute, and kept the two cables of the company busy for five hours. It is believed that this is the first time that such an important literary work has been sent over by cable. It is interesting to note that the tragedy of *Locrine*, if printed in ordinary book form, would fill 72 pages of 250 words to the page.

CELLULOID. — Among the various uses of celluloid, it would appear to be a suitable sheathing for ships, in place of copper. A French company now undertakes to supply the substance for this at nine francs per surface meter, and per millimeter of thickness. In experiments by M. Butaine, plates of celluloid applied to various vessels in January last were removed five or six months after, and found quite intact and free from marine vegetation, which was abundant on parts uncovered. The color of the substance is indestructible; the thickness may be reduced to 0.0003 metre; and the qualities of elasticity, solidity, impermeability, resistance to chemical action, etc , are all in favor of this use of celluloid.

A SIBERIAN PACIFIC RAILROAD. — The great scheme for a through Siberian Railway from St. Petersburg to Vladivostock, the naval port on the Pacific, is making progress. Communication is

already established with Ekaterinburg, and a line to Tiumen is in progress. That covers only about one-third of the distance, so that an enormous territory has still to be crossed. The projected trunk line will proceed from Tiumen to Tomsk, and thence to Irkutsk, the capital of Eastern Siberia, and next to Strelinsk on the Amoor. The route will then be for a distance by water, and finally Vladivostock will be reached by another length of line. The work of construction will be carried on from both ends, and contracts have been entered into to convey material to the Pacific port as soon as a survey which is at present in progress is completed. The line will be of immense advantage in developing the resources of Siberia, and it will enable travellers to cross from the Pacific to Petersburg in something like fifteen days.

Soldering Wires. — M. Prisiajirikov, chief of the posts and telegraphs in the government of Samara, Russia, coutributes to a Russian periodical with an unpronounceable name (consisting of fifty-eight letters) a practical note on soldering telegraph wires. In order to lessen the time required for the work, and also to avoid the weakening of the wire from scraping the surface, the author has introduced a method which consists of the use of a heating tool capable of holding a considerable quantity of melted solder, and upon the top of this is thrown sufficient powdered sal-ammoniac to leave a layer of liquid salt of some little depth. This liquid is nearly black in color. The iron wire already covered with binding wire is then pressed underneath the surface of the melted solder passing through the liquid salt. This effects a perfect solder, no matter how dirty the wire may be.

LABORATORY NOTES.

Useful Cement. — A useful cement for experimental purposes, it is said, is to be made from equal parts of gutta-percha and white-pine pitch melted together. The compound should be without lumps. It improves by re-melting, and softens at about the temperature of boiling water.

Labels and Acid. — To preserve chemical labels from acids, etc., it is recommended that after they have been attached with ordinary glue, to which a little bichromate of potash has been added, and allowed to dry thoroughly, they should be coated with hot melted paraffine, the superfluity being rubbed off with a warm flannel.

To prevent "Bumping" of Fluids during Distillation. — A. Reissmanu uses a spiral coil of platinum wire, in which are enclosed some slender fragments of pumice-stone. The specific weight of the combination must be such as to cause it to sink in the fluid. The most unmanageable fluids, it is said, are made to boil quietly in this manner. Two or more of the spirals may be required where the apparatus is a large one. He recommends also for the same purpose asbestos of long fibre, which he has found to answer the purpose perfectly. A ball of the fibres of the size of a hazel-nut placed in the retort or flask makes it possible to carry on the distillation rapidly and with perfect safety.

Cleaning Burettes. — C. Mohr states that when burettes do not completely deliver the liquid, and drops remain hanging on the sides, thus causing errors in analysis, they can be best cleaned (of the thin film of fat which occasions this annoyance) by filling with a strong solution of permanganate of potassium, and allowing it to remain a day or two; it is then run off, and the burette washed with dilute hydrochloric acid, and finally with distilled water. A burette treated in this manner delivers all the liquid. Cleaning with benzol or caustic potash will not always remove this fat.

Home, Farm, and Garden.

[Original in *Popular Science News.*]

THE ORANGE.

BY K. B. CLAYPOLE.

We are told by the early poets of Greece that among the wedding gifts offered to the Queen of Heaven were some golden apples brought by the goddess Earth.

These apples, for safe keeping, were placed in a garden on the shore of Oceanus, at the western edge of the world; and the Hesperides, the beautiful daughters of Night, were appointed their guardians. As the way to this garden was unknown and full of mysterious dangers, a visit to the Hesperides was included in many of the legends that formed round the exploits of those godlike beings, the national heroes. The Argonauts, driven by a storm from their native coast, were not allowed to turn for home again until they had reached these Western nymphs; and Perseus, returning to Argos with the Gorgon's head, lingered a while on their enchanted ground; while Hercules, the greatest of all the representatives of endurance and effort in the cause of early civilization, not only found the garden, but stole from it the golden apples, and carried them off to his exacting master in Greece.

The story of this achievement, greatly elaborated by the later classic poets, Latin as well as Greek, became, at the revival of learning in the sixteenth century, one of the most cherished myths, and scholars did not hesitate to recognize in the precious apples an allusion to the golden fruit with which they were themselves familiar. It is true, there were not wanting, even then, some critics to point out that the Greek word for apples might equally mean flocks or sheep. The metaphor of golden fruit, natural and pleasing wherever the orange was known, spread rapidly into all European languages; and the free growth of the tree in any of the favored spots assigned by classic writers to the Hesperides seemed to the student of the Renaissance sufficient proof of its close connection with the exploit of Hercules.

If, however, in those brilliant days there had been time for a closer study of the classic writings, their complete silence regarding the orange could not have passed unnoticed. The magic tree of the Hesperides, whose leaves and branches were of the same precious metal as the fruit, was in the Augustan age plainly relegated by naturalists to the realms of poetic fancy, and no one at home or abroad tried to find for it an earthly representative. And yet the times were propitious for the search. There was at this period among the upper classes of society a revival of interest in all that pertained to horticulture. Naturalists and poets of sylvan tastes studied and described the native plants of Italy and those exotics recently made known by foreign conquest. The rich man loved to surround his villa with trees new and rare, and to load his table with fruits of fabulous price brought from far distant lands. To gratify this love of luxury, one of the most potent forces of the age, the merchant penetrated even farther than the warrior had done before him. A few adventurers, passing the Pillars of Hercules, sailed cautiously down the western coast of Africa, and, finding here and there among the barren rocks a green and fertile spot, thought it no other than the very enchanted garden of the poets. But no oranges came thence to Rome. Eastward the merchant saw more chance of gain, and whole fleets of ships were occupied in the navigation of the Red Sea alone. From its shores there went to Rome gold, jewels, ivory, costly fabrics, slaves, horses, spices, perfumes, and fruits; and for these and other luxuries Rome paid two million dollars yearly. After the discovery of the monsoons the Roman merchant-ships ventured into the Indian Ocean, and reached the coast of India, and perhaps Ceylon itself, — a voyage costing five years of dangers and fatigues; and the quest was always something new and rare for the table of the epicure, something to satisfy the greed of gold and luxury at Rome. But neither from the west nor from the east of Africa, neither from Asia Minor nor Persia, from Arabia nor from the shores of India, did any one bring to Rome the orange, a tree which would at once have become a favorite, not only for its fruit, but for the fragrance of its leaves and flowers, and for the ease with which it could be propagated from seed or shoot.

But though the orange was not forthcoming to delight the classic world, its many Sanscrit names show that at least the bitter variety was well known in some parts of India many centuries before Rome's intercourse with the East began. Shortly after the Empire of the West had been forever destroyed by the barbarians of Central Europe, the Arabs, fanatic under their new religion, in one century of glorious conquest overran Persia, Syria, Egypt, Africa, and Spain, and brought all these vast regions under the power of Islam. Thus, when the fury of conquest gave place to the indulgence of luxurious tastes, the Arabs were able to push their commerce farther to the East than any people had done before them, and to carry Eastern products farther westward than had ever hitherto been possible. The orange could now no longer remain hidden among the mysteries of the East. The Arab merchant found it, and the Arab physician quickly discovered in it a medicine of extraordinary virtue.

A valuable and attractive exotic plant having been found by a people with a passion for agriculture, the next step is an attempt to naturalize it. Exactly when the orange was first brought under the notice of the Arab physicians and agriculturists, we do not know. We are told by an Arab writer of the twelfth century, that in the fourth period of the hegira (tenth century of our era) his people began to enrich their gardens at Oman with the orange-tree. From Oman in the extreme east of Arabia, the cultivation of the tree, according to the same authority, was carried by way of Bassorah and Irak into Palestine, and thence into Egypt. There is no record of the naturalization of the orange in Barbary and Spain; and yet an Arab agriculturist of the twelfth century writes as if its culture was in his time widely spread throughout the latter country, and large groves of trees are found growing wild round the ancient Moorish settlements in the north of Africa. These trees bear bitter fruit, as their ancestors did before them; for the orange of the Arab was small, highly colored and very fragrant, beautiful but nauseous.

The first orange known in Christian Europe was also more distinguished for its beauty than pleasing for the flavor of its fruit. It was, in fact, no other than the bitter orange, or bigarade, naturalized by the Arabs in the Holy Land. Growing luxuriantly in the neighborhood of Jerusalem, it attracted the admiration of the Crusaders, and the aromatic fruit was carried back to Europe as an object of curiosity. Before the holy wars were ended, the Saracens had taught the champions of the Cross to find in the bigarade a precious remedy for fever and distempers, and to use its acid juice to season fish and meat.

As early as the twelfth century successful attempts were made to naturalize the bitter orange in the islands of the Archipelago and in some

delightful spots in Sicily and Naples. The enterprise of the Genoese then brought the tree into the Riviera, where, the climate being very favorable for its growth, it was cultivated on a large scale for the essences and perfumes that could be expressed from its fragrant flowers, and for the use of its fruit in those delicious preserves for which these people were so justly famous. As the civilization of Europe advanced, and the beauty of the bitter orange was recognized, its culture spread rapidly from one country to another, penetrating even to climates where success could not be attained without the use of artificial heat.

The tree was especially pleasing to the cloistered monks, and in many an ancient monastery garden one may see to-day stocks for which great age is claimed. The orange in the court of St. Sabine at Rome is said to have been planted as long ago as the year 1200, and by St. Dominicus himself. Gallesio visited the tree early in this present century, and found it carefully tended by the Dominican monks, who believed the fruit to be endowed with miraculous powers, and distributed it to the sick. Gallesio, after a careful examination of the tree, pronounced it a shoot from the original stock, which probably perished in the destructive frost of 1709. Gallesio also paid a visit to another celebrated bitter orange-tree preserved in the Orangerie of Versailles, under the name of *Francis the First*, or *The Great Bourbon*, having been taken by the king from the constable of that name in the seizure of his effects in 1523. This was an exceedingly beautiful tree, twenty feet in height, and spreading its branches in a circle of forty feet. Gallesio, however, thought it had too vigorous a growth for a tree of the age ascribed to it, and its two stems suggested to him that it also was a second growth.

Gallesio, the Italian author to whom we are indebted for profound researches into the history of the orange, sweet and bitter, was unable to find any details of the introduction of the sweet orange into Europe. In all probability, he thinks it followed the route of the bigarade and other Eastern plants, and reached the shores of the Mediterranean by way of the Persian Gulf, Bassora, Irak, and Syria. In Syria it would be seen by merchants from almost every nation of Europe; but Gallesio shows clearly that the Genoese, in their mastery of many islands of the Archipelago, alone commanded opportunities for extending its cultivation westward.

The first traces found by Gallesio of the sweet orange in Europe occur in two important documents of the Genoese port of Savona of 1471 and 1472 respectively. But M. Adolph de Candolle cites a statute of Fermo on the Adriatic, of 1379, in which sweet oranges are undoubtedly mentioned, and states that recent researches in Spain and Portugal support the earlier date.

An opinion used to prevail that the Portuguese first introduced the sweet orange into Europe direct from India. This was probably but an inference from the name, Portugal orange, which was given in the seventeenth century to the sweet orange, and particularly to the variety with red juice. It was not until the year 1498 that Vasco de Gama first reached India by way of the Cape of Good Hope. The historian of the voyage remarks that the oranges of India are mostly sweet; but neither he nor the travellers who immediately followed him express the surprise that would be natural, had the fruit been new to them. In 1518 the Portuguese reached China, and from this time they began to import a sweeter, larger orange than the one already known in Europe.

But though the orange was not in the first place brought to Europe direct from India, it carries in its name proof of Eastern origin; for "orange" is but a modern pronunciation of the Arab *narunj*, the Hindu *nerunga*, and the *nagarunga* of the ancient Sanscrit. Moreover, the bitter orange has been reported wild from many parts of India, and it is undoubtedly native to Southern China and Cochin China.

No well-authenticated specimen of a wild sweet orange has yet been found in any country. Hindu and other Eastern traditions assign the tree to China, where the people themselves count it among their native fruits, and its first cultivation has long since been forgotten.

A PHEASANT FARM.

A GENTLEMAN utilizes his farm-lands at Lihrook, not far from London, which in these days of agricultural depression he found difficult to let, by turning them into a model game-farm. Pheasants are here reared with the most scrupulous care; and the processes of securing and collecting the eggs, hatching, nursing, and feeding the juvenile pheasants. etc., provide occupation for a number of workers. From his three thousand birds usually on the farm, the game-breeder sends pheasants all over the world to stock preserves; but he supplies eggs, most carefully packed in cases devised by himself and made on the premises, to breeders at a distance, who artificially hatch their own eggs.

The devices for securing the safety of this valuable and perishable stock are many and various, and great precautions are taken to prevent any depredation. Huge mastiffs and St. Bernard dogs traverse a length of wire cable which surrounds the farm stretched on the ground, upon which their chains are fastened in lengths of a hundred yards; and a very effectual police-force they make, not allowing approach from any one, friend or stranger, without well-recognized credentials. Rats are terribly destructive to young birds, if they can get at them; but here they are not only kept at bay by curved iron fencings, such as we see at the Zoological Gardens, but this year electric batteries are so placed, that, if a wire is touched by the marauder, the shock proves too much for him, and he tumbles over dead.

Partridges are not so difficult to deal with as pheasants, and there are thousands of them on the Lihrook farm, flying about, and taking care of themselves. All the stock birds are kept in aviaries open at the top, and their wings are clipped every three weeks. The labor of this seemed to me enormous, but the game-farmer says that it is nothing as compared to the expense of covering in forty acres of aviaries. — *Glasgow Herald.*

PARISIAN EGG CHOCOLATE.

FOR three cups of chocolate dissolve three ounces of the best chocolate in four cups of water, and set it over the fire; beat the yolks of two eggs to foam, and stir them into the chocolate as soon as it begins to froth; skim off the froth into warm chocolate-cups until they are heaped full, then hold a shovelful of burning coals to each till the froth is converted to a light crust.

The chocolate froths better when finely powdered sugar is mixed with the yolks of eggs, and still better when froth-cakes are added, prepared in the following manner: —

Beat the whites of a dozen eggs to froth, and stir in powdered sugar till the mass is of the consistency of a stiff paste. Mould the paste on a large plate into small cakes about the size and shape of an ordinary-sized hazelnut, and dry them in the sun or in a warm room. As soon as the egg-yolks have been stirred into the chocolate, add as many of these cakes as there are cups of the liquid, and continue to stir it until the whole mass becomes froth. Care must be taken to keep the chocolate near the boiling-point, whether on or off the fire, without letting it boil over.

GLEANINGS.

FEEDING SWINE. — Great pains should be observed in feeding swine. Never feed any more than they will eat clean at each meal, and not less than three times a day; plenty of fresh water should always be kept where a fattening hog can drink at any time. The practice of raking and burning all cobs and refuse in the yard at least once a week is a good one. The pigs like the charcoal made from cobs, and it will keep them clear of worms.

ELECTRIC LIGHT FOR FARMERS. — *The Electrician* states that in Southern Russia the Stepanoff primary battery is to some extent employed by the farmers during the threshing season. The only chance the Russian wheat-grower has to dispose of his crop on favorable terms is, to get it on the market at the earliest possible moment, before the American and Indian freights arrive. Threshing, therefore, is often carried on night and day.

RESEARCHES ON THE EMISSION OF AMMONIA BY VEGETABLE MOULD. — MM. Berthelot and André have investigated the cultivated clay soils of the neighborhood of Paris. This soil emits ammonia spontaneously, by reason of the slow decomposition of the amidic and ammoniacal compounds which it contains. This decomposition is effected at once under the influence of purely chemical actions due to water and earthy carbonates, and doubtless also under the influences of purely physiological actions due to fermentation, to microbia, and to vegetation, properly speaking.

METHOD PROPOSED FOR DESTROYING THE PHYLLOXERA. — Dr. Clemm has patented the following process in most civilized countries: He incorporates with the soil sulphides and carbonates, which easily undergo decomposition, preferably those of potassium. Peat, which has been made to absorb sulphuric, nitric, or phosphoric acid, is then also introduced. The acid gradually acts upon the sulphide and the carbonate, liberating sulphuretted hydrogen and carbonic acid in the soil. These two gases, according to the experiments of Dr. Eyrich of Mannheim, are rapidly and uniformly distributed, and prove fatal to the *Phylloxera* in its underground stage, as well as to Colorado beetles, field-mice, moles, etc. The potash remains in the soil as a sulphate, nitrate, or phosphate. The question is, whether useful animals, such as earthworms, humble-bees, carnivorous ground-beetles, etc., will not be destroyed also.

BEER. — Professor Schwackhöfer delivered a lecture recently to the Vienna Hygienic Society on the subject of beer. After giving some statistics on the consumption of this beverage, the lecturer went on to describe its manufacture and adulteration. The birthplace of beer is Egypt. A papyrus has been discovered on which a father reproaches his son for lounging about in taverns and drinking too much beer. From the Egyptians the art of brewing descended to the Ethiopians. Whilst the Romans despised beer, the Germans of the North of Europe fully appreciated its good qualities. However, the refreshing draught became more popular in the first half of the Middle Ages. In the beginning only convents obtained the monopoly of brewing beer, but later on the privilege was extended to lay corporations. In Austria the first brewery was established in Vienna in 1560, and beer soon became the favorite beverage of all classes of society. At present the yearly production throughout the whole world amounts to 5,600,000 gallons, England taking the lead, with about 2,000,000.

The Popular Science News.

BOSTON, FEB. 1, 1888.

JAMES R. NICHOLS, M.D.
WILLIAM J. ROLFE, Litt.D. } . . . . . *Editors.*
AUSTIN P. NICHOLS, S.B.

JAMES ROBINSON NICHOLS.

It is with the deepest sorrow that we announce to the readers of this paper the death of its senior editor, Dr. James R. Nichols, which occurred at his home in Haverhill, Mass., on the 2d of January. Although he had been in poor health for some months, his symptoms were not sufficiently serious to cause his friends any anxiety till about three weeks before his death, when his digestive organs, which were always weak from his boyhood, refused to assimilate any nourishment; and he gradually grew weaker, till he passed away quietly and without pain.

He was born in West Amesbury, now Merrimac, Mass., July 18, 1819. Up to the age of seventeen years his life was passed upon the farm which was the homestead of his great-grandfather, a descendant of emigrants from Wales. At that age he became a clerk in the drug-store of his uncle, Moses Nichols, in Haverhill. His only education had been such as he had acquired in the common schools of that day, which chiefly consisted of a winter term at the district school; but this, with his studious habits and retentive mental powers, was sufficient to lay the foundation for his future business and scientific success. The field into which he thus early entered proved to be one well suited to his tastes and business capacity; and he immediately began, through systematic reading and the study of such scientific works as were within his reach, supplemented by the accumulation of facts in the school of practical experience, to acquire a fund of knowledge, which at length made him widely known as a self-educated scientific and business man. His work of education began when he was a farmer's boy; and what he then acquired remained with him through all his future life, evidence of which was shown in the deep love for agricultural pursuits, which was manifested in maturer years, and opened the way for deeper research into the mysteries of nature in growth and production.

In 1842 he attended a course of medical lectures at Dartmouth College, and received from that institution the degree of M.D., and afterwards the honorary degree of A.M. He never practised medicine professionally, but in 1843 established a drug-store in Haverhill, devoting his leisure time to the study of theoretical and practical chemistry, and to his numerous inventions, many of which are widely used at the present time.

In 1856 he made an extended tour through Great Britain and Europe, and soon after his return, in 1857, disposed of his drug-business, and established in Boston the firm of J. R. Nichols & Co., for the manufacture of fine chemical and medicinal preparations, at that time a comparatively new industry in this country.

In addition to the chemical works of the firm in Boston, Dr. Nichols built a laboratory at Haverhill, which was successfully operated for several years; but it was finally given up, and all the business concentrated in Boston. In Boston's great fire the wholesale drug-store and the chemical works were destroyed, after which he withdrew from the firm, and the business was resumed and is still carried on by his former partners under the name of Billings, Clapp, & Co.

In 1866 the *Boston Journal of Chemistry* was established as an auxiliary to the business of the firm. Although intended at first to be principally an advertising publication, it soon obtained a high position as a journal of popular science, and a circulation extending to all parts of the United States and Europe. In 1883 the paper was purchased by the present proprietors, and its name changed to the *Popular Science News*, but Dr. Nichols remained in editorial connection with it up to the time of his death; and although in later years impaired health and the pressure of business affairs, compelled him to leave the direct management to his editorial associates, he always took great pride in the paper, and constantly contributed to its columns, his last article being the one on "Tea-Poisoning," which appeared in the December number.

As an agricultural chemist Dr. Nichols was pre-eminent, and many readers of this paper will remember the interesting and valuable accounts of his experiments at Lakeside Farm which have been published from time to time. This farm was purchased in 1865, and is believed to be the oldest experimental farm in the country. The changes in the processes of cultivation proved a great success, as shown in the Massachusetts State Reports, and also in the running history of the work appearing in the *Journal of Chemistry* and in other scientific and agricultural records. Extensive reclamation was made of the low lands by drainage and new processes of cultivation, and hitherto unproductive territory was made to teem with abundant crops.

In 1878 he was appointed by Gov. Rice a member of the Massachusetts State Board of Agriculture. He contributed many valuable papers to the literature of agriculture; among these are most prominent his essays upon the "Proper Way of reclaiming Wet Meadows," "Water in Agriculture," "Artificial Fertilizers," "What Science has accomplished for Husbandry," "Muck: its Uses in Agriculture," "Nitrogen in its Relation to Agriculture," and many others of a kindred nature. Upon the high lands composing a part of the estate, which became known as "Winnekeni," he conceived the idea of erecting a stone structure in mediæval style, to become his summer residence. The location is delightful, commanding a charming landscape view, embracing within its range several mountains whose names are historic. This structure was completed about 1875, and was built almost entirely of granite bowlders found upon the farm. It remained his summer residence until two years since, when it was sold to a relative, who still makes it his summer home.

His business relations were numerous and extensive. After retiring from the chemical firm, he became, in 1873, president of the Vermont and Canada Railroad, holding the office until 1878. The position was one of responsibility, and occupied much of his time. In the same year of his election to that office he was also elected on the board of directors of the Boston and Maine Railroad, and has been annually elected a member of the board since that time.

In 1867 he was appointed one of the trustees of the Essex Fund established by the late George Peabody of London, and was a trustee of the Peabody Academy of Science. He also held many local positions of trust in Haverhill and neighboring towns.

Although thoroughly conversant with the theoretical principles of chemistry, Dr. Nichols's attention was more particularly directed to the practical side of his favorite science. He introduced many new and improved chemical and pharmaceutical compounds, and by his inventive genius devised simple and economical methods and machinery for their manufacture. His numerous inventions in other fields also bear witness to his talent. All the modern forms of soda-water apparatus, portable gas-machines, and carbonic-acid fire-extinguishers, as well as the leather-board industry, are based either upon his original patents or inventions. An improved form of hot-air furnace was devised by him in later years, and has come into extensive use. During his early life many of the most wonderful inventions of modern times were introduced, and experiments with the telegraph, telephone, daguerrotype, and spectroscope were undertaken by him almost simultaneously with their announcement.

It is perhaps, however, as an author that Dr. Nichols will be best remembered. Prior to 1872 two well-known works, entitled *Chemistry of the Farm and Sea* and *Fireside Science*, were published, which have been extensively read, furnishing much information, in a popular style, upon the subjects treated, and have contributed to increase his literary reputation. These were for the most part compiled from articles written at different times for this paper. During the summer of 1882 he composed, at his country residence, the work *Whence, What, Where?* which has already passed through eleven editions. It was originally written with the purpose of recording his thoughts on the important subjects of which it treats, for his own gratification and that of a few of his most intimate friends. A small edition was printed for private distribution; but such a general demand arose for copies, that it was transferred to the hands of a publisher, and has since been read in all parts of the world. The composition of this work was a source of the highest pleasure to Dr. Nichols; and letters received

from numerous readers have shown that it has been a source of comfort and consolation to many, and has awakened a responsive chord in the hearts of all.

Dr. Nichols was an extensive reader in all departments of literature. His private library was one of the finest in the State, and contained many rare and valuable works. In 1876 he founded a public library in his native town of Merrimac, and remained one of its trustees during his life. His tastes were notably artistic, and it was one of his greatest pleasures to enjoy with his friends the treasures of science, art, and literature with which he embellished his home.

During his entire life Dr. Nichols was much interested in that class of phenomena now known as "psychic." Few men have had better or more extensive opportunities for investigation; and although he was convinced that there is a scientific basis for these phenomena, his attitude was that of a patient investigator, preferring to wait for "more light," equally avoiding the absurdities of the professional "Spiritualists" on the one hand, and the dogmatic denials of irrefutable facts by those of a more materialistic belief. His views as expressed in his own words are: —

A ray of light is already observed darting over the distant hilltops; and it gives promise of more diffusive beams, which will penetrate the darkness that hides the future world from view.

Now that he has passed into the state of existence concerning which he has reasoned so clearly and wisely in this world, we can have no doubt that all things have been made plain to him, and that the great problem of whence, what, where? has been solved in the only way in which it may ever be solved to those who would learn the secret of life.

In his private and personal relations Dr. Nichols was universally respected and beloved. His nature was sympathetic, and his benevolence widespread and unobtrusive. He had always a kind word for every one, and there were none who gained his friendship but were the wiser and better for it. None can know better than the writer those qualities which so endeared him to his family, and made their home the happiest of all places on earth to them. He was a kind and indulgent father, whose sympathy and aid were never withheld, and whose loss will be felt more and more as time passes on. Death came to him at last as he would have wished, and his own words in this connection were almost literally fulfilled in his own case: —

There is no evidence to show that nature intended death to be cruel or painful to the mind, or physically painful to the body. The natural man should know no more concerning his own death than his own birth. He comes into the world without the consciousness of suffering; and if the perfect law can be fulfilled, he will die oblivious to all pains, mental and physical. At his birth he sleeps into existence, and awakens into knowledge: at his death he dozes into sleep, and awakens to a new life.

And so, when the summons came for him to join the "innumerable caravan," he left this earthly life —

"Like one that wraps the drapery of his couch
About him, and lies down to pleasant dreams."

A. P. N.

To this filial tribute, one who had known Dr. Nichols intimately for a quarter of a century, during a large part of which time we were associated in the editorial management of this journal, can only add a hearty indorsement of all that is said in his honor and praise, especially in regard to his personal relations with all who had the privilege of his friendship. To all such, like "that royal merchant, good Antonio," he was ever

"The kindest man,
The best-conditioned and unwearied spirit
In doing courtesies."

W. J. R.

THE BACON-SHAKESPEARE LUNACY.

A discussion of the theory that Francis Bacon was the author of the plays and poems which for more than three centuries have been ascribed to William Shakespeare, may seem to be out of place in a scientific journal; but the subject has its scientific bearings. We are told that Bacon wrought certain of his scientific opinions into the plays, and we may properly inquire whether there is good evidence of this. The various forms of insanity are also legitimate subjects for discussion in a journal partially devoted to medicine; and this Baconian theory may fairly be regarded as one of the strangest instances of literary lunacy in these "cranky" times of ours.

The subject has also its relations with industrial art. The Donnelly "cryptogram," as it is called, has recently revived the popular interest in the delusion; and one of the many ways of showing up the absurdity of the alleged discovery of a cipher narrative interwoven in the text of the first collected edition of Shakespeare's plays, the Folio of 1623, is by proving that the insertion of the secret story was typographically impossible at that time. This has been done by Mr. W. H. Wyman of Cincinnati, a gentleman familiar with the history and details of the printer's art.

The Baconian theory is literally a baseless one, the fundamental assumption on which it rests being absolutely false; namely, that Shakespeare could not have written the works ascribed to him, and that Bacon could have written them. On the contrary, every careful student or critic is inevitably forced to the conclusion that the works *must* have been written either by Shakespeare or by some man whose education and experiences were like his, so far as we have become acquainted with them; while it is absolutely impossible that they could have been produced by a man whose training and fortunes were what we know Bacon's to have been. The facts concerning Shakespeare's personal history that have come down to us are few indeed, but they furnish a key to much that would otherwise be perplexing in his writings; and, on the other hand, the writings throw light upon the life, and assist us in filling out the meagre outlines of the biographer. In these latter years the chronology of the plays has been pretty well made out, and all the more important questions concerning their authorship — what plays are wholly Shakespeare's, what are his only in part, how the mixed authorship is to be explained, etc. — have been satisfactorily settled. Now, the better we understand the order and the history of the plays, the clearer it is that they are the work of a playwright who began his career, and who went on step by step in that career, as we know Shakespeare did. It is evident that the author was not an amateur writing plays in the intervals of his more serious occupations, but a man who had his fortune to make, and who, after securing some humble position in the theatre, worked his way up as actor and dramatist until he had gained reputation and wealth by his labor. Our limits here in the *News* will not permit us to trace him through all the stages of his career as actor and author. Suffice it to say that, from first to last, we recognize him as the practical man of the theatre, no scholar, but familiar with the requirements of his profession, and endowed with *genius* that made him to a great degree independent of learning and literary culture.

The Baconian heretics assume that the author of the plays was a learned man. Certain good scholars and critics somehow got this notion into their heads in former times; but the misconception could only have been possible (except to a Baconian) before the plays had been minutely examined, their anachronisms and other literary defects carefully scrutinized, and their relations to the sources whence their materials were drawn critically investigated. This kind of study shows that, marvellous as was the *genius* of the author of the plays, and the insight into human nature with all its capabilities and possibilities which that genius gave him, he was not only no scholar, but the lack of scholastic training was in certain minor respects a serious disadvantage to him. If he had had the learning of Bacon superadded to his own natural gifts, he would have done his work differently and in some respects better.

Shakespeare's use of his historical materials is a striking illustration of his lack of learning. In the Roman plays, for example, he draws his material almost exclusively from Plutarch's *Lives*. Bacon was, of course, perfectly familiar with Plutarch in the original Greek, and would have gone to the original if he had written the plays, rather than to a translation of a translation (Sir Thomas North's English rendering of Bishop Amyot's French version); or, if it were conceivable that he should resort to this as a matter of convenience, he would at least have corrected the palpable misprints and corruptions which had crept into North's book. Shakespeare was not familiar enough with the minutiæ of Roman history to put "*Decimus* Brutus" in place of North's "*Decius* Brutus," or *Calpurnia* as the name of Cæsar's

wife instead of the impossible Latin form *Calphurnia*. Bacon could as soon have written the "Richard Conqueror" of Sly the tinker as this "Decius Brutus." Indeed, he gives both this name and *Calpurnia* correctly in a passage in his *Essay on Friendship*, which is quoted by Judge Holmes (*Authorship of Shakespeare*, p. 289) to show the similarity of style in the essay and the play. The judge believes that a comparison of these and other passages which he quotes must make it plain that Bacon wrote the play; and yet nothing can be clearer than the fact that the author of the essay was perfectly familiar with what the writer of the play was ignorant of.

In *1 Henry IV.* (i. 1. 71) the king speaks of

> Mordake the Earl of Fife, and eldest son
> To beaten Douglas;

but he was not the son of Douglas, but of the Duke of Albany. How did Shakespeare make this mistake, which Bacon could never have made? He was misled by the accidental omission of a comma in the edition of Holinshed's Chronicle, which he followed. Mordake is thus apparently described as "son to the gouvernour Archembald earle Dowglas," and not merely son to the governor, or Regent of Scotland, the office then held by the Duke of Albany.

A careful scholar may occasionally be guilty of slips like those, but there are too many of them in the plays to justify this excuse for them all. A man of Bacon's training and habits could not have fallen into such repeated and preposterous mistakes, especially in history, where he was thoroughly at home.

Again: the make-up of the Folio of 1623 is of itself a complete refutation of the Baconian theory. According to Donnelly, this famous volume was most elaborately revised and "doctored" by that eminent dramatist Francis Bacon, in order that it might preserve to coming generations the cryptographic evidence that he, and not Shakespeare, was the author of its contents. According to Judge Holmes, Mrs. Pott, and others, it was published by Bacon two years after his downfall, at a time (to quote Mrs. Pott) "when his failing health caused him to press forward the publication of all his works." The differences between the earlier quarto editions of certain plays and the folio are said to be due to the revision of these plays by the author. Now, if we assume that the folio is just what it purports to be, a collection of plays made after the author's death, by two of his fellow-actors, — persons of small culture, and no experience as editors, — who did little except to gather up old manuscripts that had been used in the theatre, and were more or less dog's-eared and mutilated, to say nothing of the abridgment and alterations to which they had been subjected for stage purposes; the earlier quarto editions, perhaps interlined and modified in the theatre, being, in the case of some of the plays, used instead of manuscript copies; and all this matter put through the press, according to the usage of the time, with no proof-reading worthy of the name, — if we assume this to have been the history of the volume, its peculiarities and its imperfections are, in the main, easily accounted for. But if it is to be regarded as an edition compiled by the author, and presenting the plays in the revised form in which he desires to hand them down to posterity, and especially if we are to believe that he has inserted, in the text of certain plays, the secret evidence that they are his, and not another's, — if this is the view of the volume that we are to take, its peculiarities are absolutely inexplicable. No author, least of all one so orderly and systematic as Bacon, ever issued a collection of his works in such a fashion, — so badly arranged, so wretchedly printed, — with such inequality of wretchedness withal, for some portions of it are far worse than others in respect to misprints and corruptions of the text. If it is the author's own revised edition, how are we to explain the fact that it contains plays which are manifestly nothing more than a slight remodelling of earlier work by other hands? that others are apparently pieces left unfinished, and completed by another playwright; in some cases by one so inferior to the original author, that he could never have willingly allowed his work to be touched by such a bungler? If it be said (as by a very small minority of critics) that all the matter is from one and the same hand, this is not inconceivable, if the collecting and publishing of the works has been done by an incompetent or unscrupulous editor after the author's death; but how can we explain it if the author himself is editor? Why, to refer to a single play, should *Timon of Athens* be left in the state in which we find it, — pure gold with a large admixture of the basest alloy; stuff utterly unworthy of the dramatist, even in his 'prentice days? Scarcely a critic of the present century has been willing to regard the play as the work of a single hand. Portions of it are written in the merest burlesque of verse, as if the author had no ear, unless an asinine one, and the thought and sentiment are in keeping with the versification; while other portions are in the poet's most mature and finished style. The Baconians tell us that this play was one of the latest, if not the very last, which their philosopher wrote, and that Timon is meant as a representation of himself, deserted by his parasite friends after his fall. If so, is it conceivable that he could have written it as we have it, or that, if any inferior writer had a share in it, Bacon would have printed it all as his own? These and similar questions concerning the folio have never been put to the Baconians, so far as we are aware, and we cannot guess how they would attempt to answer them. *Can* they answer them satisfactorily?

Some of the arguments of the Baconians, based upon supposed *scientific* allusions, etc., in the plays, are extremely comical, but we have left ourself no room to quote and discuss them. Possibly we may at another time point out the numerous scientific errors made by the writer of the plays.

THE SENSES OF ANIMALS.

Sir John Lubbock recently delivered a lecture to the members of the Edinburgh Philosophical Institution on "The Sense and Senses of Animals," in the course of which he said, according to the *Mechanical World*, that there had been so many important recent works published relating to his subject, that he thought it would be more interesting were he to deal, for the most part, with his own observations. Different ideas prevailed regarding the question of the intelligence of animals. Some people regarded a dog as an animal almost as wise and clever as themselves; but, on asking them if they thought a dog could realize that two and two made four, he generally found a good deal of doubt on the point. Sir John Lubbock then described the system which he had adopted in the training of his own black poodle-dog, "Van." He had placed two pieces of cardboard, on one of which was printed in large letters the word "food," the other being blank, on two saucers. In one of the saucers was food, and the card with the word upon it. In the other, the blank card and no food. In about ten days the dog began to distinguish the card with the letters from the plain card, and would go at once to the printed one. The lecturer then related in some detail his successful efforts in inducing the dog to bring him the proper card when he wanted food, in teaching him to know other cards containing the words "out," "tea," "bone," "water." On bringing the card marked "out," he would rush to the door. The cards were not put in the same places, but in different positions; and in order that the dog might not be guided by scent, other cards with the same markings were used. No one who saw him look down the row of cards, and pick out the one wanted, could doubt that he sought a particular card for a particular object. He had found, at the end of three months' experiments, that he could not get the dog to realize the difference of colors, and it was just possible that the dog might be color-blind. He had also failed to get the dog to distinguish among one, two, three, or four broad bands upon the cards. In order to ascertain if bees were sensible to sounds, he had placed some honey on a musical box on his lawn. The box played for ten days without stopping, and then he removed it to a window-sill on the first floor of his house. Not a bee came to it. He again placed it on the lawn, and they again returned to the honey. He next brought it into the drawing-room on the ground floor, about ten yards from its former position, but they did not follow; but on his bringing two or three bees into the house, and putting them on the honey, they began to feed, and, flying off, returned with their companions. It seemed as if they did not hear the tune. Regarding the old idea that bees would not swarm unless they were "tanged" by the creation of sounds, he was under the impression that it was the "overtones" which the insects heard, and which were inaudible to our ears. The sounds were so low as to be beyond our range of hearing. Man, he said, had five senses, and fancied that no others were possible; but it was obvious that we could not measure the infinite by our own narrow limitations. Even within the penetration of our own senses there might be endless sounds which we could not hear, and colors of which we have no conception. There was also the other question still remaining for solution, that the familiar world which surrounded us might be a different place altogether for other animals, in which there was music we could not hear, colors we could not see, and sensations which we could not conceive. The pursuit of such studies gave a clew to senses and perceptions of which we had no conception.

[Specially reported for the *Popular Science News.*]

METEOROLOGY FOR DECEMBER, 1887, WITH REVIEW OF THE YEAR.

TEMPERATURE.

Average Thermometer.		Lowest.	Highest.	Range.
At 7 A.M.	25.90°	4°	55°	51°
At 2 P.M.	35.68°	14°	58°	44°
At 9 P.M.	27.68°	5°	54°	49°
Whole month	29.75°	4°	58°	54°
Second average	29.23°	4°	58°	54°
Last seventeen Dec's	28.25°	21.29°	36.04°	14.75°
Second average	27.47°	20.98°	35.84°	14.86°
Year of 1887	46.94°	—14°	92°	106°
Last seventeen years	47.51°	45.15°, in 1875.	49.57°, in 1878.	4.42°

The month began and closed with extremely cold weather. The lowest observations were only 4° above zero, on the first, and 5° on the last, mornings of the month. The 30th was the coldest day, with an average of 8⅔° ; the first day averaged 11⅓°, and the last 14°. The 11th was the warmest day, with an average of 55⅔° and a range of only 4°. The highest point was 58°, at the midday observation. The preceding day and the following were also unusually warm for the season, the three days having an average of near 47°. The entire month was 1½° above the average of the last seventeen Decembers. The extreme Decembers are given in the table above, with their wide range. The temperature of the entire last year was a near average of the last seventeen years, being less than six-tenths of a degree below that average

THE SKY.

The face of the sky in 93 observations gave 38 fair, 9 cloudy, 32 overcast, 9 rainy, and 5 snowy, — a percentage of only 40.9 fair. The average fair the last seventeen Decembers has been 49.6, with extremes of 40.9, in 1887, and 75.3, in 1877; showing the present December to have been the least fair in seventeen years. Full one-third of the month was noted overcast, not including the rainy or snowy days. The evening of the 11th, a warm day, was foggy, followed by several clear, fine days. A number of beautiful sunsets occurred during the month, that on the 12th being unusually fine.

PRECIPITATION.

The amount of precipitation the past month, including 5 inches of snow melted, was 4.38 inches; while the average for the last nineteen Decembers has been 3.87, with extremes of .73, in 1875, and 7.89, in 1884. The largest fall at one time was 1.55 inches, on the 28th. About 4 inches of snow fell on the 26th and 27th, starting a few sleighs; but on the following day snow fell, changing soon to rain, with a strong east and south-east wind, which swept away nearly all appearance of snow before night. The amount of precipitation the past year, including 68 inches of snow melted, has been 44.59 inches; while the average for the last nineteen years has been 45.67, with extremes of 32.26, in 1883, and 57.58, in 1878.

PRESSURE.

The average pressure the past month was 30.021 inches, with extremes of 29.10, on the 18th, and 30 80, on the 1st, — a range of 1.70, the highest point reached by the barometer in this locality for fifteen years. It was remarkably high in all the north-eastern section of the United States, varying from 30.70 to 31 inches at twenty of the thirty-four stations of the signal service, — at Washington, 30.80 ; Philadelphia, 30.82; Boston, 30.86; Albany and Buffalo, 30.96; and at Oswego, 31 full inches The average pressure of the last fourteen Decembers has been 29.953, with extremes of 29.804, in 1876, and 30.073, in 1879. The sum of daily variations the past month was 8.13 inches, giving an average daily movement of .262 inch. This average in fourteen Decembers has been .259, with extremes of .190 and .329. The largest daily movements were .87, .73, and .57, all in connection with storms. The first third of the month was of uniformly high pressure.

WINDS.

The direction of the wind in 93 observations gave 19 N., 1 S., 6 E., 19 W., 8 N.E., 6 S E., and 7 S.W., — an excess of 40 northerly and 33 westerly over the southerly and easterly, and indicating the average direction of the month to have been W. 50° 29′ N. The westerly winds in the last eighteen Decembers have uniformly prevailed over the easterly by an average of 54.44 observations, and the northerly over the southerly, with two exceptions, by an average of 18.56; indicating the approximate general average for December to be W. 18° 49′ N. The longitudinal extremes have been 33 W. and 76 W., — a range of 43; and the latitudinal 40 N. and 9 S., — a range of 49. The relative progressive distance travelled by the wind the past month was 51 86 units, and during the last eighteen Decembers 1,035 such units, — an average of 57.50 ; showing more opposite winds the past month than usual. The wind in connection with the storm on the 28th became very violent for a short time toward the close of the day.

	Temperature.			Face of the Sky. Percentage Fair.			Rainfall, in Inches.			Pressure, in Inches.			Direction of the Winds, combined from 8 Points.		
	17 yrs.	1887.	Diff.	17 yrs.	1887.	Diff	19 yrs.	1887.	Diff.	14 yrs.	1887.	Diff.	18 years.	1887.	Difference.
Jan.	23.87°	22.33°	—1.54°	53.4	45.2	— 8.2	4.03	7.39	+2.76	29.960	29.927	—.033	W. 21°15′ N.	W. 20° 2′ N.	— 1°13′ N.
Feb.	25.60	26.17	+0.57	57.0	48.8	— 8.8	4.97	6.85	+1.88	29.963	30 096	+.133	W. 26°53′ N.	W. 32°44′ N.	+ 5°51′ N.
March.	32.29	29.66	—2.63	50.2	44.1	— 6.1	5.15	6.45	+1.30	29.879	29.825	—.054	W. 30°46′ N.	W. 44°22′ N.	+13°36′ N.
April.	44.83	43.28	—1.55	50 8	54.4	+ 3.6	3.98	4.04	+0.06	29.880	29.926	+.046	W. 38°57′ N.	W. 40°37′ N.	+ 6°40′ N.
May	57.43	60.60	+3 32	56.3	57.0	+ 0.7	2.83	0.84	—2.01	29.941	30.038	+.097	W. 3°52′ N.	W. 5°32′ S.	+ 9°24′ S.
June	66.78	66.01	—0.77	59 7	52.2	— 7.5	2.80	2.27	—0.53	29.933	30.018	+.085	W. 23°21′ S.	W. 19°11′ S.	— 4°10′ S.
July	71.55	74.81	+3.25	62.6	43.0	—19.6	3.08	3.23	+0.15	29.919	29.976	+.057	W. 28° 1′ S.	W. 28°28′ S.	— 4°33′ S.
Aug	69.04	66.23	—2.81	63 3	54.8	— 8.5	3.42	3.38	—0.04	29.962	29.962	.000	W. 20°21′ S.	W. 34°17′ N.	+54°38′ N.
Sept.	61.42	57.30	—4.06	60.3	60.0	— 0.3	2.40	0.88	—1.51	30 024	30.110	+.086	Due W.	W. 25°54′ N.	+29°54′ N.
Oct.	50.99	48.68	—2.31	57.8	49.5	— 8.3	4.00	2.36	—1.64	30 092	29.976	—.026	W. 10°56′ N.	W. 25°54′ N.	+14°58′ N.
Nov.	38.06	38.36	+0.30	55.5	57.8	+ 2.3	3.92	2.42	—1.50	29.977	29.976	—.001	W. 16°13′ N.	W. 21°37′ N.	+ 5°24′ N.
Dec.	28.25	29.75	+1.50	40.6	40.9	+ 8.7	3.87	4 38	+0.51	29.953	30.021	+.068	W. 18°49′ N.	W. 50°20′ N.	+31°40′ N.
Totals.	47.51°	46.94°	—0.57°	56.4	50.6	— 5.8	45.66	44.59	— 1.07—	29.949	29.988	+.038	W. 10° 5′ N.	W. 24°17′ N.	+14°12′ N.

The above table of comparisons is very comprehensive, showing at a single view the meteorology of the last year, compared, month by month, with that of a series of years, in each of the five departments of observation. The table chiefly explains itself. I may notice, however, under the head of

Temperature, the first column, how peculiarly the scale rises from January, the coldest month, to July, the warmest, and then declines by very nearly corresponding degrees to January; the most rapid changes occurring just after the equinoxes, and the least rapidly just after the solstices. The year 1887 was a near average, as a whole, and yet several months differed widely from their appropriate average, as May, July, and September. The first column under

Percentage fair, shows that our most cloudy months in seventeen years have been December, March, and April. There is also apparent a regular increase and decrease through most of the year, but especially in the warmer months. By longer observation a more regular scale may be found to exist through the year, or with certain exceptions. The sun is a mighty ruler of the clouds as well as heat. The year 1887 was peculiarly cloudy, especially July, which, instead of being one of the brightest months, came near being most cloudy of all.

The rainfall is scarcely less valuable than the heat of the sun, and is caused by it; yet our hottest months are not the most rainy. March stands at the head, with February and January closely following, while June and September are at the other extreme. The year 1887 was an inch below the average, the winter months being largely in excess, leaving most of the warm season quite deficient.

The *pressure*, observed at the morning and evening hours only, is constantly varying, and yet under laws as exact as gravitation itself, with modifying influences. September and October maintain the highest pressure, March and April the lowest. The year 1887 was above the average, five months exceeding an average of 30 inches. The highest point reached in fifteen years was 30.80 inches, in December, 1887, and the lowest was 28 70, in November, 1873, — a range of 2.10 inches, indicating a difference of more than one pound to the square inch.

The *winds* are among the most fickle of all things; and yet these, too, have laws, which become manifest by careful study. After eighteen years' observation three times daily, a degree of order is noticed, even in the winds. Beginning with September, we find the average of that month to be due west. October follows with an inclination W. 10° 56′ N., and so on to April, a constant northerly increase for seven months; then a sudden decrease in May, 28° less northerly, followed by other warm months with a strong *southerly* inclination. In examining the winds of 1887 we find wide contrasts, especially with May and August, each largely reversing its usual order. September, October, and December were largely north, causing the entire year to be 14° 12′ more northerly than usual. The yearly excess of the northerly over the southerly winds in eighteen years has been 80½, while that of the year 1887 was 212. With such extremes and fickleness, we need longer observation to secure even an approximate average with satisfaction.

D. W.

Natick, *Jan.* 6, 1888.

[Specially reported for the *Popular Science News* from the Observatory of the College of New Jersey.]

ASTRONOMICAL PHENOMENA FOR FEBRUARY, 1888.

There will be an eclipse of the Sun on Feb. 11, invisible in the United States. The only accessible

land which the eclipse track crosses is the extreme southern portion of South America, below latitude 40° south.

Planets. — Mercury comes to greatest eastern elongation on Feb. 17, and may be seen as an evening star soon after sunset, low down near the western horizon, for a few days about that time. Venus is still a morning star, but is gradually approaching superior conjunction. At the end of the month it rises less than two hours before the Sun. Mars rises at about 11 P M. on Feb. 1, and at a little before 10 on Feb. 29. It is below and to the left of Spica (*Alpha* Virginis), and increases its distance from that star from about 4° to 9° during the month. Jupiter is a morning star, rising at about 2.30 A.M. on Feb. 1, and at a little before 1 A M. on Feb. 29. It is moving slowly eastward, and is about 7° north and west of the first-magnitude star Antares (*Alpha* Scorpii). Saturn is in Cancer, and comes to the meridian a little before midnight on the first of the month, and about two hours earlier at the end. It is somewhat nearer Castor and Pollux than during January. Uranus is in Virgo, and about 5° west and north of Spica. Neptune is about 6° south of the Pleiades.

Constellations. — The positions given are for 10 P.M. Feb. 1, 9 P.M. Feb. 15, and 8 P.M. Feb. 29. Gemini is near the zenith; the principal stars, Castor and Pollux, being a little south and east Canis Minor, with the first-magnitude star Procyon, is on the meridian to the south; and below that is Canis Major, with Sirius, the brightest of the fixed stars Cancer, with Saturn, is just east of Gemini, and Leo is about halfway from the eastern horizon to the zenith, while Virgo is just rising in the east. Ursa Major is high up in the north-east, and Bootes is below it on the horizon. Ursa Minor and Draco lie principally to the east and below the pole. Cassiopeia is in the north-west, about the same altitude as the pole star. Just west of the zenith is Auriga; below this and a little to the north of west is Perseus; and Andromeda is near the horizon, below Perseus. Taurus, with the groups of Pleiades and Hyades, is a little south of west, and below it are Aries and Pisces. Orion is about halfway between Taurus and the southern meridian, the principal stars being at a little lower altitude than those of Taurus.

M.

Princeton, N.J., *Jan.* 6, 1888.

Correspondence.

Brief communications upon subjects of scientific interest will be welcomed from any quarter. The editors do not necessarily indorse all views and statements presented by their correspondents.

DO HORSES HAVE SENSE?

Editors Popular Science News:

Reading an article in the *News* of January, 1888, entitled "Do Horses have Sense?" suggested a few instances that have come under my personal observation, and which are evidence to me that horses *do* have considerable sense, unless frenzied by a burning building, and have an opportunity to exercise their wits. However, there are as many grades of intelligence in horses as in mankind.

My father owned a black mare which showed unmistakable evidence of reasoning. At one time in winter, being let out in the yard to get a drink, she went up to the trough, and found it frozen over. Now, the water came into the trough from above in a brisk stream, and nearly always kept it open, and previous to this time she had not seen it covered with ice: so she lifted one of her fore feet, gave the ice two or three smart blows, broke the ice, and obtained water.

Another horse would open doors and gates. If the door closed with a latch, and the latch was pinned down by a nail placed above it, he would draw the nail with his teeth, and open the door. He would invariably beat any combination we could put on an ordinary method of closing a door or gate.

But the best instance, and in another locality, was a horse that would pump water (for himself, of course). He would seize the pump-handle between his teeth, and work it up and down until a sufficient amount was obtained, then go and drink it. If other horses came to drink while he was pumping, which was often the case, he would wheel around, kick them away, and go on with his work.

He learned this by himself, and in this manner: naturally he associated the trough and pump with the water he wanted to obtain; and when he went to the trough and found it dry, he would nose around, and, happening to raise the pump-handle, observed a little water flow out of the spout. He saw that the moving of the pump-handle would cause the water to flow, and continued moving it up, then down, and afterwards would seize the handle deliberately with his teeth, and pump almost as fast as a man would.

This instance is no creation of the imagination. I have seen him do it, and can refer to many others who have witnessed the same And if it does *not* show a distinct process of reasoning, then I do not know what reasoning is.

Very truly yours,

L. A. Frost, M D.

Jacksonville, Ill., *Jan.* 9, 1888.

WHOLE WHEAT AS AN ARTICLE OF DIET.

Editors Popular Science News:

I am pleased to see in your last number, for January, 1888, an article written by Dr. Cutter of New York concerning the use of whole wheat as an article of diet If it were new to me, I probably should have said nothing more about it; but as I have been in the habit, for more than twenty-five years, of advising the use of whole wheat as an article of diet to many of my patients afflicted with obstinate constipation, I thought it might not be amiss to speak of it. As an article of diet wheat heads the list of all the grains, and is much better in the natural state, when properly cooked, than after it has been maltreated by grinding, bolting, etc.

When properly cooked and used, I consider it one of the most healthy and efficient remedies for that malady or bane of the people of New England, — constipation. It is a trouble that destroys annually thousands of valuable lives, directly or indirectly. I have at the present time many patients who do not think of getting along without the daily use of cooked wheat.

There is no drug the equal of it for a natural relief and cure of constipation. Oatmeal is very indigestible in cases of dyspepsia or weak stomachs, and many people will recover from the disease by leaving off the use of oatmeal.

My directions for preparing wheat for the table differ a little from those of Mrs. Cutter — perhaps a trifle more simple. Directions for cooking: Take one pint of whole wheat, wash clean, and let it soak in cold water over night, and the next day boil or cook the same as you would rice, or until it is thoroughly soft, when it is suitable for table use. As Dr. Cutter has made no mention of the use of whole wheat other than being palatable, I have taken the liberty of sending you this note.

H. H. Hill, M.D.

Augusta, Me., *Jan.* 4, 1888.

DO WORMS FALL DURING SHOWERS?

Editors Popular Science News:

I saw this query in the January number of the *Science News*, by J. H. H., and one fact related, among others, which seems to have led him to make this inquiry. My experience has been similar to his; and my belief is, that they fall down I have repeatedly seen these earth-worms in caldron kettles suspended on long poles by bails or chains, and having no connection with the ground only through the bail or chain, and the pole and its rests; and in many other situations I have found them where I considered it impossible for such worms to get without falling down, as in sap-troughs, and buckets, tubs, pans, etc. A fact in connection with these circumstances is, that, unless discovered in a short time after getting into these vessels or traps, they are dead, — drowned, I suppose; showing that they are incapable of climbing out of the enclosing wall, whatever it might be, as a pail or pan, inclined outward, which they must have ascended in an opposite inclination from the outside, if we suppose the worms helped themselves in by crawling up from the ground.

Another fact which no doubt has come within the observation of many, which may not be so convincing, but which I think must be accounted for in the same way, is this: After or during a smart, warm shower in summer, after a dry spell, the observer may see, if he is favorably situated, in a hard-trodden dooryard or road (sometimes at least), numerous earth-worms wriggling around. Now, I think we cannot satisfactorily account for the sudden appearance of so many worms in so short a time, through so hard a crust of earth as I have seen them, only in the way I have suggested. I am inclined to think that these worms do not appear in every shower, but occasionally; under what particular circumstances, my observation has not yet enabled me to determine.

I have seen them sometimes in quite cold weather, but more generally in warm. I have given some facts and my belief, but at present I will leave the explanation to others.

M. Holley.

Corinth, Mich., *Jan.* 6, 1888.

Editors Popular Science News:

After several months' stay in Mexico, I have just returned. Early in November last, after a slight rain, in passing over a regularly travelled road, for the distance of three miles I found the road and vicinity literally covered with small brown frogs three-quarters of an inch in length, hopping about in all directions. Where did they come from?

J. A. M.

Philadelphia, *Jan.* 3, 1888.

QUESTIONS AND ANSWERS.

Letters of inquiry should enclose a two-cent stamp, as well as the name and address of the writer, which will not be published.

Questions regarding the treatment of diseases cannot be answered in this columu.

N. C., *Worcester.* — In certain cook-book recipes the use of saleratus is directed without cream of tartar or other acid. How can this salt alone possess any "raising" power?

Answer. — In saleratus, or bicarbonate of soda, a part of the carbonic-acid gas is loosely combined, and is driven off by the heat in cooking. Less than one-half of the gas is thus available; and, unless there is some special reason for dispensing with it, the cream of tartar should be used.

Inquirer, *Boston.* — What is the cause and remedy of offensive breath?

Answer. — This condition may depend upon so many different causes, that it would be impossible to give a satisfactory answer. If the teeth and mouth are kept clean, and the stomach is in good order, the breath will

rarely be offensive; but in some cases the trouble is very difficult to remedy, and may depend upon obscure causes, which a physician alone could detect.

N. P. K., *Philadelphia.* — Why do we never see but one side of the moon?

Answer. — The moon revolves on its axis in the same time that it completes its journey round the earth, and therefore always presents the same side towards us. There are slight variations in these motions, called *librations*, by which we are enabled to see a little more than a single hemisphere of our satellite.

I. N. B., *Virginia.* — Wheu brown sugar has caked in the barrel, and is cut with a hatchet, I have sometimes observed a phosphorescent glow. What is the cause? Does it come from the phosphorus in the bone-black used in refining it?

Answer. — The phosphorescence is an inherent quality of sugar, and is not due to the bone-black. The actual cause of it is unknown. The same phenomenon can be observed by any one by breaking, in the dark, the large sugar lozenges sold by confectioners and druggists.

E. J. H. — At the latest accounts two hundred and seventy-one asteroids had been discovered; but new ones are constautly found, and the number of these little planets seems to be indefinitely large.

LITERARY NOTES.

A Practical Treatise on Animal and Vegetable Fats and Oils. By William T. Brannt. Philadelphia: Henry Carey Baird & Co. 244 engravings. 1 vol. 8vo, 739 pages. Price $7.50.

This work is the first treatise of the kind in our literature which does any thing more than dip here and there into this highly and widely important subject. The great work of Dr. Karl Schaedler, upon which it is largely based, is well kuown to technologists and other chemists as the most complete and reliable book on fixed oils, animal, vegetable, and mineral, published in Europe; but Mr. Brannt, the accomplished American editor, has added largely to the work of Dr. Schaedler, especially in the departments of volatile oils and lubricants. The matter of Mr. Brannt has been collected from widely extended sources, and treats very thoroughly those oils which are peculiarly American, whether fixed or volatile, more especially cotton-seed, lard, peppermint, sassafras, birch, etc. We would advise our readers that the publishers have adopted a system of issuing with each of their new and important publications a circular giving the full table of contents aud specimens of the illustrations. Such a circular of this book can be had on application to the publishers.

The Asteroids, or Minor Planets. By Daniel Kirkwood, LL.D. J. B. Lippincott Company, Philadelphia. Price 75 cents.

This interesting little book gives a complete history of the numerous asteroids between Mars and Jupiter, with a complete list of those discovered up to the date of publication, their elements and orbits, and a discussion of the various theories concerning their origin and their relation to the other members of the solar system. It is well worth perusal by every one interested in astronomy.

A Popular Mineralogy and Geology. By Katherine E. Hogan. A. Lovell & Co., New York, publishers. Price 50 cents.

This little work gives a great deal of interesting information about the subjects of which it treats, and is largely compiled from the leading authorities of America and Europe. It is especially adapted for the use of those having no previous knowledge of the sciences, as it is written in an exceedingly clear and popular style.

The director of the United States Geological Survey at Washingtou has issued the volume for 1886 of the *Mineral Resources of the United States*, which contains a large amount of valuable information and statistics regarding the mining and metallurgical industries of the country. He will send a copy to any address on receipt of a fifty-cent postal note.

We are indebted to the Pope Manufacturing Company of Boston, Mass., for a novel and convenient business calendar for 1888. It is so arranged that memoranda can be made on the dated slips for any future time, and readily turned to.

Pamphlets, etc., received: *On a Collection of Birds' Sterna and Skulls collected by Dr. Thomas S. Street*, by Dr. R. W. Shufeldt, U.S.A.; *Octonary Numeration, and its Application to a System of Weights and Measures*, by Alfred B. Taylor, A.M.; *Progressive Muscular Atrophy, beginning in the Legs*; and a *Report on Progress in Medicine*, by J. B. Marvin, M.D.

Medicine and Pharmacy.

THE ANTAGONISMS OF COCAINE.

COCAINE continues to attract much attention in medical circles, and many new facts concerning it are being discovered and reported. According to recent German investigations, the drug has "a stimulating effect on the psychic and motor nerve-centres, increases the rapidity of breathing, quickens the heart's action, and promotes chemical change going on in the tissues." From its action on the nerve-centres, it is declared to be "the best of known stimulants." In this respect it is in marked antagonism to chloral, which "depresses the functional activity of these centres." If an animal has been narcotized by a dose of chloral that would otherwise prove fatal, it can be roused and saved by the injection of a small dose of cocaine.

In regard to temperature, however, this antagonistic action fails. It is well known that chloral tends to lower the animal temperature, while, on the other hand, cocaine tends to raise it. In some instances a rise of 4° C. in the course of half an hour has been observed; but, after poisoning by chloral, this effect of cocaine is not produced. In all other respects the antagonism of the two agents is complete, dangerously large doses of chloral proving harmless after the administration of small doses of cocaine. It is suggested, however, that as the first effect of cocaine, notwithstanding its subsequent action as a stimulant, is to depress the respiratory function, it is advisable, in cases of chloral-poisoning, to induce artificial respiration for a short time after administering the cocaine.

Cocaine is also antagonistic to chloroform and ether, and the inhalation of either of these agents will allay the convulsions due to poisonous doses of cocaine. The severer symptoms having been thus allayed, chloral may be afterwards given to keep up the effect. On the other hand, cocaine may be used as an antidote in cases of poisoning by narcotic agents, especially such as cause great depression of the respiratory and cardiac centres.

It may be added, that cocaine is found to be a perfect substitute for strychnine, as it has all the therapeutic activity of that drug, without any of its poisonous qualities.

[Original in *Popular Science News.*]

SANITARY SCIENCE AND DOMESTIC ARCHITECTURE.

BY JOHN CROWELL, M.D.

IV.

NEARLY every well-appointed dwelling has a room called the library, and it is quite apt to be located in some obscure and dark corner or angle of the house, shut out from the light and air of street or courtyard. Many city libraries are so dark that it is difficult to read or write on a cloudy day without the aid of artificial light. To people of literary tastes the library is an important room. It is a convenient place for quiet work, and even the business-man loves to seek its restful seclusion after the strain of the day's duties in the counting-room or on the exchange. The room, therefore, should be light, cheerful, and unique in all its appointments. The furniture and finish should not be too sombre and heavy, and the uses of the apartment should be suggested in every adornment and fixture. The bookcases should be made to hold books rather than to display the caprices of antique ornamentation and carving, and they should be so constructed that the books can be reached without stooping too low or reaching too high. There should be a substantial table for study and writing, cabinets for large folios, easily adjusted portfolios for the display of pictures, and just enough of bronze, marble, and paintings to suggest the uses and refinements of the room. Too often the modern library has too much of the *bizarre* in its appearance, with a lack of elegant adornment and quiet repose, always indicative of a cultivated taste and scholarly habits. Library pictures should deal in domestic scenes for their subjects; hence the fine interiors as shown on the canvasses of Gerard Dow, Mieris, Houghton, Faed, or Millais, are in place, as well as historical and allegorical scenes, with a sprinkling of the reproductions of the mediæval masters, as seen in some of the copies of old frescoes. A cold, damp, "stuffy" library is an incongruity not to be tolerated. If you are in the country, let this room look out upon the broad lawn, with a boundless view of field and sky from the great bow window. The study of Charles Dickens at Gad's Hill was full of sunshine, and his writing-table stood in the unobstructed glow of the window opening upon the lawn. If a man possesses literary tastes, he will soon give to his library a certain kind of individuality that is its chief charm.

Great care should be taken, in planting shade-trees, not to place them too near the house, especially in a Northern climate. Oftentimes the dwelling is made damp, and even mouldy, by the obstruction of light and air from the dense foliage of the large shade-trees. There should be open spaces, and great vistas of scenery among the groves; and the sunshine should be allowed to penetrate the rooms, even in the hottest days. How often, when entering the house of some rural neighbor, do we feel the damp chill, and smell the earth-mould, in the dark, cheerless parlors or library! Closets are rendered unfit for clothing, and beds are pervaded with a clammy odor that makes them dangerous for occupancy. Therefore cut down all trees that are superfluous, and severely prune the rest, and let the house glow in the light and warmth of the day. One of the common nuisances of large estates is the proximity of the stable to the house. Quite often, for convenience' sake, the stable is connected with the house by a covered way, making a sure communication of stable odors to hall and chamber. This odor is inevitable; and no matter how great may be your precautions, you will surely encounter it when entering the house. Another objection to having the stables near the house is the noise made by the horses, especially in warm nights. If the grounds will permit, stables should be located at least fifty feet from the dwelling. There should be no place in back-yard, area, or open space, for the accumulation of any kind of filth or rubbish, for the air that feeds your furnace-flues comes from these spaces, and nothing foul nor unclean should ever pollute the vital current. A concreted area is the safest protection against dampness and disagreeable odors. The air of the house will be the same as the air of your surroundings, hence the necessity of having purity about your own premises. Great care should be taken in piping a house for gas. The joints should be secure, and fixtures should be of simple patterns, with few joints, especially in sleeping-rooms. A leaky gas-pipe in a con-

cealed place is a disagreeable and dangerous foe; and in piping a house for gas, as for sewerage, the pipes should be so arranged as to be easily exposed to view. Nothing but thorough testing by a scientific expert can make a house absolutely safe from the danger of gas-leakage. In a large house the servants should be instructed as to the proper means of escape in case of fire, and back staircases should be sufficiently open and easy of access in order to secure safety in case of a panic by fire or from other cause.

Back-stairs are often a nuisance by reason of the narrow and steep flights, and a wise economy would suggest that the part of the house where the hard work is done should be of generous dimensions, and convenient in construction. Basement kitchens and dining-rooms are very common in city dwellings; and unless they are built upon a dry bottom, and above the line of the sidewalk, they are very objectionable, both on account of dampness and darkness. Yet, because of the expensiveness of land, they are of general use in some cities as a matter of economy. Boston is almost peculiar in this arrangement, but in Philadelphia a basement kitchen is hardly known. It is very difficult to make a basement dining-room elegant or desirable, and every sanitary writer and critic pleads for the abolishment of such apartments. The Southern custom of having the culinary and laundry appliances in a small building separate from the house has many advantages, especially in ridding the rooms of the disagreeable odors inseparable from these necessary quarters. A kitchen in an L is preferable to one in a basement for obvious reasons. What is more disagreeable on entering a house than to encounter the odors from the kitchen as soon as one opens the hall-door? and nothing save fire and absolute destruction will neutralize some of the stenches that arise from certain kinds of cooking A well-ventilated kitchen, with improved apparatus for cooking, is one of the greatest triumphs of modern house-building. How many safeguards are necessary in the construction of the healthy home! Every hint from scientific discovery, every fact from the broad field of investigation, every valuable invention of the ingenious artisan, and all the devices that the forms of beauty and the more practical forms of utility ever suggest, must be considered, and their forces conserved to the highest and noblest uses of refined and healthful living. Under such direction, domestic architecture rises to a nobler art, guided by the protecting care of sanitary science. Under such intelligent conditions life is worth living, and a house is worth living *in*, to the end of time.

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HOW TO TREAT THE EYE WITH A CINDER IN IT.

R. W. St. Clair writes the *Medical Summary* as follows:—

"Nine persons out of every ten with a cinder or any foreign substance in the eye, will instantly begin to rub the eye with one hand, while hunting for their handkerchief with the other. They may, and sometimes do, remove the offending cinder; but more frequently they rub until the eye becomes inflamed, bind a handkerchief around the head, and go to bed. This is all wrong. The better way is, not to rub the eye with the cinder in at all, but rub the other eye as vigorously as you like.

"A few years since, I was riding on an engine. The engineer threw open the front window, and I caught a cinder that gave me the most excruciating pain. I began to rub the eye with both hands. 'Let your eye alone, and rub the other eye [this from the engineer]. I know you doctors think you know it all; but if you will let that eye alone, and rub the other one, the cinder will be out in two minutes,' persisted the engineer. I began to rub the other eye; and soon I felt the cinder down near the inner canthus, and made ready to take it out. Let it alone, and keep at the well eye," shouted the doctor *pro tem*. I did so for a minute longer, and, looking in a small glass he gave me, I found the offender on my cheek. Since then I have tried it many times, and have advised many others, and I have never known it to fail in one instance (unless it was as sharp as a piece of steel, or something that cut into the ball, and required an operation to remove it). Why it is so, I do not know; but that it is so, I do know, and that one may be saved much suffering, if they will let the injured eye alone, and rub the well eye."

—•—

[Specially compiled for the *Popular Science News*.]

MONTHLY SUMMARY OF MEDICAL PROGRESS.

BY W. S. WELLS, M.D.

Cases of hydrophobia are published in the *Medical Gazette* (India), among which is that of an officer under the care of Surgeon-Major P. J. Freyer. The patient was bitten on the hand by a mad pup a year and a half before the development of the hydrophobic symptoms, which ended fatally. The remedies tried were morphia and atropine given hypodermically.

Dr. Freyer directs attention especially to one point in the case; viz., that the *first* symptom was *pain in the cicatrix of the old bite*. He considers that this points to the disease being localized in the neighborhood of the bite for a considerable period; and he is led to believe that the poison received from the bite of a rabid animal does not, as in the case of snake-poisoning, rapidly invade the system, but remains localized at the seat of injury for an indefinite period, and, maturing there by some peculiar process, suddenly, after the lapse of days, weeks, months, or years, invades the system.

Upon this exceedingly plausible theory he explains the fact that the first symptom in the actual development of the disease was pain in the seat of the bite; and upon this theory the practical lesson taught is the free removal or free destruction of the part bitten, by excision or caustics, or both, as soon as practicable.

Care should be taken that the fleshy parts around the bite should be freely excised considerably beyond the margin of the bite, and then thoroughly cauterized, and subsequently dressed.

Should a surgeon not be at hand to excise the wound, apply lunar caustic, a live coal, or a red-hot nail, wire, or other iron, down into the bite, deep enough to destroy the tissues around the bitten part into which the hydrophobic poison is lodged. If this course has not been followed as a precautionary measure at the time or soon after the bite, the cicatrix and surrounding tissues should be excised subsequently.

Dr. Freyer is of the opinion, that, in the case of the officer alluded to, if excision had been performed even shortly before the active symptoms set in, although a year and a half after the bite, the disease would not have ended fatally.

At a recent meeting of the Berlin Medical Society Hahn reported fifteen partial or total extirpations of the larynx. Of their patients, two were living. One was operated upon seven years ago, and is in good health, aged sixty-nine. In this case the extirpation was very extensive, and the specimen was typical carcinoma. The second case was operated on one and a half years previously, and was partial.

Hahn believes that carcinoma which shows a tendency to horny or warty growth has a more favorable prognosis than other carcinomata. He thinks that most operations are undertaken too late, and that malignant tendency contra-indicates operating at all.

Brown-Séquard reported, in *L'Union Médicale*, a series of experiments on rabbits and birds, in which he produced a kind of rabies by injecting oil of tansy. This rabies he was able to overcome by subcutaneous injections of chloral, and surrounding the subjects with vapors of this drug, and believes, from analogy, that chloral so administered would prove to be a preventive of true rabies in man.

Dr. Feltz, in *L'Art Médical*, relates the following as a possible explanation of the occurrence of left-handedness. In a family composed of five persons, the father and mother were right-handed, as was also the eldest son, who had been cared for in his infancy by a nurse. The second child had been nursed by the mother, and was left-handed The third child, also nursed by his mother, was at the age of one year evidently left-handed, never grasping any object with his right hand. Dr. Feltz noticed that the mother carried the child on her left arm, and, upon being questioned, said it had always been her custom to carry her children on this arm. The doctor advised her to hold the child on her right arm.

She did so; the child soon began to use his right hand in seizing objects, and is now, at the age of ten years, normal as regards the preference of the right over the left hand. The doctor explained that when the nurse carries the child on her left arm, the left arm of the infant is the one which is free, and which consequently he learns to use, to the neglect of the right.

Bucquoy says, in a recent monograph on duodenal ulcer, that the diagnosis depends upon, (1) intestinal hemorrhages, with tar-like feces occurring suddenly and abundantly shortly after meals, causing extreme anæmia; (2) pain at the close of stomach digestion in the right hypochondrium, sometimes with reflex nervous phenomena; (3) vomiting, icterus occasionally, and a remarkable preservation of the appetite. The duodenal ulcer occurs most frequently in men.

The treatment is nearly the same as that of gastric ulcer, but the exclusive milk diet need not be persisted in for so long a period.

Dr. Wentscher reports, in the *Berlin Klin. Woch*, a case of ileus cured by intestinal puncture and one washing-out of the stomach, as recommended by Kussmaul. The obstruction had lasted ten days. A coil of intestine was clearly marked on the left side, above the umbilicus, and a fine trocar introduced. Gases of not very bad odor passed through the canula, and also a teaspoonful of opaque green-white fluid of fecal odor.

The abdominal swelling immediately collapsed.

The stomach-pump was also used shortly after, and the relief was prompt.

An article is published in the *Gazetta Degli Ospitali* by M. Taruzza, on the value of effused blood in treating wounds. He claims that hemorrhage from wounds, unless due to lesion of large vessels, or in excess, does not interfere with primary union. He does not think it necessary to follow strictly the rule to secure complete arrest of hemorrhage, and to apply firm compression. He relies on perfect disinfection of the bleeding-surface, as far as possible, by means of weak solutions of carbolic acid or mercuric chloride. After

this he leaves the cavity of the wound full of blood, the edges being accurately sutured, and without fear that primary union will not result.

His experience is, that, in wounds perfectly disinfected and free from foreign substances, effusion of blood is not a source of danger, but the reverse, as the effused blood fills the wound-cavity perfectly, preventing the formation of empty spaces, and making compression and drainage superfluous, and the organization of the clot favors union. He is opposed to the drainage-tube, thinking that it increases risks of sepsis, and may remove from the wound fluids which, when aseptic, may be useful by re-absorption.

DR. A. C. W. BEECHER reported recently to the Philadelphia County Medical Society a case of simple fracture of the distal phalanx of the index-finger which he treated by applying a narrow bandage from the end of the finger to the second joint, making two layers. This he coated thickly with collodion, which, drying and hardening quickly, made a neat, smooth, and stiff water-proof casing, which was worn with but one change until the fracture was cured.

IT is stated, in the *Arch. Med. Belges*, that fluid extract of Quebracho applied to a wound, a burn, an ulcer, or a frost-bite, is more healing even than iodoform. Spread over such a surface, it dries in the course of half an hour, forming a tough and very adhesive brownish crust, which can be removed, as desired, by soaking in warm water. In the interim cicatrization progresses rapidly.

In the *Arch. de Med. y Cir. de los Niños* Dr. G. Alvarez reports a case of convulsions in a child eleven months old, in which a diagnosis had been made of meningitis, but, as no other symptoms of this disease were present, the doctor was inclined to regard the spasms as reflex in nature. The child was stripped, and it was seen that he was suffering from strangulated inguinal hernia. After considerable difficulty the hernia was reduced by taxis, and a truss was applied.

The convulsions ceased at once, and there was no return.

DR. GENEUIL writes to the *Bulletin Général de Therapeutique*, that, after having tried various means to arrest epistaxis in children, he tried lemon-juice, and for twelve years has had, from its use, the best results, with no failures. His method is, first to wash out the nostrils with an ordinary urethral syringe, and then, having removed all clots, he injects with the syringe the juice of the freshly squeezed lemon. He found that almost always one injection is sufficient to stop the bleeding in two minutes. He did not get such results from using citric acid.

DR. W. T. DODGE, Marlette, Mich., reports to the *New York Medical Record* a case of persistent vomiting, after labor, arrested by tincture of iodine, after all the usual remedies had failed, such as lactopeptine, carbolic acid, nitrate bismuth, lime-water, etc.

The labor required the use of forceps, and the patient was much exhausted; but the uterus contracted well. Antiseptic precautions were at once adopted. The labor was followed by atony of the bladder, and the doctor confesses he improperly yielded to the solicitations of the patient for chloroform anæsthesia during catheterization. Irritability of the stomach followed, and on the third day her stomach rejected every thing.

Then, medicines failing, all attempts at nourishment by the stomach were discontinued, and nutritive enemata were given every two hours, combined with hypodermic injections of brandy. Notwithstanding, the vomiting and nausea continued until the evening of the fifth day, when her condition was critical, — the pulse 130, temperature 101° F., with symptoms of impending collapse. The uterus was firmly contracted, abdomen free from tenderness, and the lochia normal. So the doctor could not diagnose septicæmia. At this juncture he recollected having seen an article by Dr. Eliot, reported in the *Record*, recommending tincture of iodine. He at once gave five drops of the tincture of iodine in a tablespoonful of sweetened water. Two hours later, the retching and vomiting were under control, and she desired food. Milk in lime-water was given and retained. Twice slight nausea returned, but was quelled by the iodine. She made a rapid recovery.

MEDICAL MEMORANDA.

DR. LONGSTRETH recommends a large-handled knife for post-mortem operations, as less tiresome to use than one with a small handle.

SOFT, thin, waxed paper is found to answer the purpose of oiled silk or muslin in the majority of dressings, and is very much cheaper.

AN ELEPHANT'S STOMACH. — Professor Seguin and Dr. Godfrey dissected the carcass of the elephant Alice, burned in the fire at the Barnum & Bailey winter quarters in November. In the stomach was found over three hundred pennies, part of a pocket-knife, four cane ferules, a piece of lead pipe, and some pebbles.

LOTION FOR THE SKIN. — A correspondent of the *Medical World* writes: —

"While a student at Old Jefferson, I learned to use a lotion which has the curious property of preserving the skin from the effects of cold, preventing chaps, and rendering the hands soft, white, and smooth. One need not wear gloves in winter if this be used constantly: —

"R. Ol. rosæ	gtt. xv.
Glycerinæ	ʒ j.
Sp. myrciæ	fl ʒ iij.
Ol. cajuputi	gtt. xx.

"M. S. — To be used on the hands every night before going to bed; and in cold weather to be applied before going out into the open air, the hands being first washed and dried."

THE CROWN PRINCE OF PRUSSIA. — Dr. Sommerbrod of the Breslau University, an eminent laryngologist, lectured on the case of the Crown Prince in Berlin Dec. 6. He is inclined to the conclusion that it is a case of simple perichondritis with abscess formation, and not of a cancerous nature, though some difficulty is likely to be presented in the extrusion of several pieces of dead cartilage. He said the prospects of the Prince's recovery were hopeful.

DYSENTERY. — Dr. Rennie reports that cases of dysentery which have been unsuccessfully treated with opium and ipecac have been cured by tincture of cannabis indica, which he has given, however, in conjunction with carbonate of bismuth and aromatics.

INTERNAL USE OF GLYCERINE. — Dr. Tisne asserts that glycerine taken internally exerts a beneficial effect upon nutrition, increasing the weight, and palliating many of the distressing symptoms of phthisis, such as loss of appetite, diarrhœa, night sweats, and insomnia. Its action on the liver is manifested by an increase in the size of the organ, and a more abundant flow of bile. It has a diuretic effect, and increases the excretion of urea, the chlorides, and phosphates. The alkalinity of the urine is diminished, and if any pus be present in this, it is greatly lessened in amount.

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Remittances will be duly credited on the printed address label of the paper; but if they are received after the 15th of the month, the change in the label cannot be made until a month later. If a formal receipt is desired, a two-cent stamp or a postal card should be enclosed with the remittance.

Publishers' Column.

MESSRS. MARIANI & CO., 127 Fifth Avenue, New York, will send free, to any physician mentioning this paper, a treatise on coca erythroxylon and its uses in the treatment of disease, with notes and comments by prominent physicians.

IMPERIAL GRANUM has now been before the public for many years, and is generally admitted to be a standard preparation. There can be no doubt that this is due to its uniformly superior quality, and the successful results obtained with it in all cases where an artificial food is required.

HYDROLEINE is not only a perfect emulsion of cod-liver oil and water, but is so treated that the digestive process is already partially effected, thus allowing it to be assimilated by the weakest stomachs. It has often been used with the best results in cases where the pure oil proved unsatisfactory.

DR. EUSTACE SMITH of London, physician to the Children's Hospital, and author of *Wasting Diseases of Infants and Children*, says: "MELLIN'S FOOD is by far the best of any with which I am acquainted. It seems to agree equally well with children whether they are healthy or diseased."

ST. LOUIS, MO., Oct. 18, 1887.

MR. DAVID BOYLE, CHICAGO, ILL.

Dear Sir, — In reply to your favor of the 18th inst., we are pleased to state that we have had one of your twenty-five ton refrigerating machines in constant work since 1880. Your machine had done all that you claimed for it up to time you put on your improvements, and since then the machine has done a great deal more than was expected.

We are thoroughly satisfied with the operation of your machine, and think it is the best machine in the market to-day.

Yours truly,
N. K. FAIRBANK & CO.

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The Popular Science News

AND

BOSTON JOURNAL OF CHEMISTRY.

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CONTENTS.

FAMILIAR SCIENCE. — How to Make a Sun-Dial 33
An Experiment upon Magnetic Induction 33
On the Study of Nature 34
Natural History Notes 35
Botany as a Recreation 35
Government Meddlesomeness 36
Interesting Discoveries at Pompeii 36
Scientific Brevities 36

PRACTICAL CHEMISTRY AND THE ARTS. — A Rotary Thermometer 37
A Simple Method of Illustrating Chemical Equivalents ... 37
A Gelatine Battery 37
Modern Explosives 37
The Flight of Birds 38
Levying Duty on Electricity 38
Laboratory Notes 38
Industrial Memoranda 38

HOME, FARM, AND GARDEN. — Household Hints 39
A Device for Measuring Blossoms 39
Scientific Facts for Housekeepers 39
Color in Plants 40
Gleanings 40

EDITORIAL. — Prehistoric Monuments in the Pyrenees 41
Berlin Letter 42
Astronomical Phenomena for March, 1888 43
Meteorology for January, 1888 43
Do Horses have Horse Sense? 44
The Recent Western Blizzard 44
Literary Notes 44

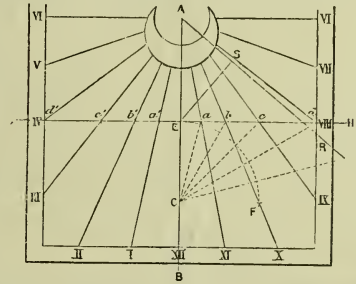
MEDICINE AND PHARMACY. — The Healing Art 45
Monthly Summary of Medical Progress 45
The Hygiene of Phthisis 46
The Doctor's Wife 47
On Measuring Liquids by Drops 47
A Chinese Medicine Advertisement 48
Medical Memoranda 48
Humors 48

PUBLISHERS' COLUMN 48

Familiar Science.

HOW TO MAKE A SUN-DIAL.

A SIMPLE sun-dial can be easily made out of wood or pasteboard, which may be placed out of doors in any convenient place, or upon the window-sill of a room with a southern exposure, and will indicate the solar time as accurately as the more expensive stone or metal dials. The method of drawing the hour-lines is as follows: Take a piece of wood or pasteboard of any convenient size, and draw upon it the line AB, which will be the noon or XII-o'clock line upon the dial. Then make the angle BAR, which must equal the latitude of the locality. At Boston this would be about $42\frac{1}{3}°$. From any point upon AR, as S, draw SE perpendicular to AR; and at E draw GEH perpendicular to AB. Measure upon AB, EC equal to ES, and from the point C as a centre draw the quarter-circle EF, which is to be divided into arcs of 15°, commencing at E. Through these divisions draw the lines Ca, Cb, Cc, Cd, etc.; and then from A draw the lines passing through a, b, c, d, etc., which will be the hour-lines, where the shadow will fall. Lay off on GE the points Ea', Eb', Ec', Ed', equal to Ea, Eb, Ec, Ed, and draw the hour-lines from A through them in the same way. It should be noted that the VI-o'clock line is a perpendicular to AB drawn through A. The point to which the VII-o'clock line is drawn is not shown in the diagram, for lack of room; but it is found in the same manner as the others, — by extending the line EH, and extending the lower dotted line from C till A intersects. The hour-lines before six in the morning and after six in the afternoon are a continuation of the lines on the opposite side of A. Thus, the V hour-line in the morning is found by extending the V hour-line for the afternoon through the point A. The style which is to cast the shadow is of the shape of the triangle EAS,



with the side AS, which casts the shadow, prolonged to any convenient length. It must be placed upright on the dial in the direction of the line AE.

To set the dial in position, it is only necessary to place it at noon-time so that the shadow of the style falls along the XII line. It should also be remembered that the solar, and clock or mean time rarely agree, and the proper correction must be found. This is given for every day in the year in many almanacs. Thus, if the sun is found to be ten minutes fast, the shadow must fall upon the noon-mark at ten minutes of twelve by the clock. There is also a constant correction to be made, owing to the use of "standard time" in different sections of the country. At Boston this amounts to about fifteen minutes, which must be added to the clock time without regard to the difference between the sun and the clock. Thus, when the clocks at Boston mark a quarter to twelve, the sun is on the meridian, and it is really twelve o'clock. In the longitude of New York and Philadelphia this may be disregarded, and only the correction as given in the almanac used.

We can only say, in conclusion, that these directions are much simpler than they appear at first sight, and that any one possessed of an elementary knowledge of geometry, and a pair of drawing compasses and a protractor, will find no difficulty in making for himself a useful and entertaining piece of horological apparatus.

AN EXPERIMENT UPON MAGNETIC INDUCTION.

IF a piece of metal is rapidly moved before the poles of a magnet, currents of electricity are induced in it, and, by their reaction upon the magnet, tend to stop its motion. This phenomenon was first observed by Arago in 1824, and was more fully demonstrated and explained by Faraday. He suspended a cube of copper to a twisted thread which was placed between the poles of a powerful electro-magnet. Left to itself, it began to spin round with great velocity, but stopped the moment the electro-magnet was excited by a current of electricity. In a similar way, if a knife-blade is moved backwards and forwards between the poles of a strong magnet, great resistance is felt, "as if the knife was cutting through cheese;" and it may even become heated the same as by actual friction. This principle is practically made use of in the construction of delicate galvanometers, where the oscillations of the magnetic needle are controlled and "dampened" by the proximity of a mass of copper.

The illustration shows a very simple and effective way of showing this effect of induction. A top is constructed out of a piece of tin or sheet-iron. When it is at rest, the metal will be attracted by a magnet in the usual way; but if rapidly rotated, and the magnet brought over it, the induced currents will

cause it to be *repelled* by the magnet. The energy of this repulsion will be proportional to the speed of rotation; and as this diminishes, the repulsion becomes less and less, and at a certain point the attractive influence is again exerted. If the poles of the magnet are held to the edge of the revolving disk, — that is, parallel to the plane of rotation, — the induced currents will neutralize each other, and no effect will be observed.

This apparent paradox of the attraction and repulsion by a magnet of the same piece of

metal, is a striking illustration of the effect of induced currents; and the experiment with the top is especially well adapted to illustrate it in the lecture-room or before a class of students.

[Original in *Popular Science News.*]

ON THE STUDY OF NATURE.

BY PROFESSOR N. S. SHALER.

I.

Modern science has done much to better the condition of humanity. It is easy to see on every side the vast advantages accruing to man from the discoveries of recent years. A thousand burdens have been lightened; from the cheapening of food to the lengthening of days, men have found their profit in science. It is probable, however, that the greatest gain which can come from our better understanding of nature is one which is still to be appropriated by the masses of men; viz., the good which will accrue from the better understanding of the universe in which they dwell.

The old view of the world — a view which rendered it hopeless for man to be intellectually reconciled to his surroundings — was unhappy, in that it placed men in an attitude of conflict with nature. The realm of Providence was limited to those things in which the Infinite directly interfered with the course of nature for the benefit of those who might receive such comforts. The world at large was looked upon as a vast chaos of uncontrolled action. It is true that the best teachings of Christianity were to the effect that the Divine pervaded nature, but this view was little recognized in the religious faith of men. To most, the universe as a whole remained as the abiding place of evil. Science has gradually destroyed this primitive notion of nature, and is bringing men to perceive that all things work together, and work together for good; that the whole is in one hand, and not the battle-field of discordant powers.

So far, only those who deal much with science, and not even all those followers of natural law, have perceived the beauty of this accord in the world about them. It has, however, come to all devoted students of nature — to all, at least, save the few who enter on their work with overmastering prejudices — to conceive this world as a place where exquisitely ordered forces control the march of events. Every true naturalist finds this conviction to enter into his soul, and the fulness of his faith is the reward he receives for his labor. It is easy to bring to men the immediate, tangible profits of a wonderful discovery. It is hard, indeed, to find the way in which this enlargement of the understanding as to the ways of the world can be brought into their minds. The dominant spirit of utilitarianism causes men to grasp at once upon the advantages of a tangible sort afforded them by scientific work. The shadowy profits which the naturalist wins, though the best which comes to him from his endeavors, escape them. It is of the utmost importance that this peculiar confidence in nature which the naturalist obtains should become the property of all men, and not remain, as at present, the peculiar blessing of a few.

At first sight, it seems difficult to provide the general public with any such insight into the depths of the world's affairs as is required for the communication of this peculiar spirit. But few can be naturalists in the larger sense of the word. Not more than one in a thousand at most of the people in our busy societies can spare the time from the ordinary occupations of life to attain to this peculiar training. The question arises, whether the sense of nature can be given without the elaborate education of the professional student of natural science. It appears to me that it can be afforded to all those who care to seek in any way for the higher gifts of culture, even if in their seeking they are hampered with the ordinary burdens of a busy life. So far, our effort to develop by teaching the sense of relations in nature, has, it seems to me, been greatly misdirected. In our schools we endeavor to inform the student as to the facts of the different sciences. In this way we perhaps instruct him concerning a wide range of phenomena, teach him to classify animals, to name the heavenly bodies, or to tell something of the succession of events noted by the geologist. From all this, he generally gets about as much of a knowledge of nature as one does of European history by committing to memory the names of sovereigns, or the successive battles which have taken place on that continent. If, in such a system of training, the student should compass in his memory all that has been written concerning natural phenomena, he would not thereby become in the true sense a naturalist. He would gain no insight of an available sort into the world about him, and would certainly fail to acquire that peculiar confidence in the world which it should be the first aim of his work to afford him. Let us suppose that we take a child from its mother's arms in early infancy, place him in some unloving care, taking pains at the same time during the process of his growth to lecture him ceaselessly on the nature of maternal love. Could we expect the youth to have any such sense of affection for his unseen mother as he would have attained to if he had been brought up in immediate relations with her? Yet something like this we do, when, without any close personal contact with nature, we endeavor to instruct a youth as to the qualities of his great mother, the world from which he has come.

If a sense of nature depended on a very wide range of knowledge, manifestly it would be impossible for the most of men to attain to it. We should have to look forward to the institution of a race of prophets or scientific men who were privileged to journey into the remote land, and now and then bring back some preservable fruits as sad tokens of how good that realm is, and yet how unattainable to their fellows. Fortunately, however, we are sure to find out, after more or less abortive trials of our present system of education, that the sense of nature does not demand a wide training, though it does call for one very different from that we now seek to give. A true sense of the natural world can be obtained with comparatively little actual knowledge, provided that knowledge be gained by deliberate, thoughtful, personal experience. It hardly matters how limited is the field of learning, provided it be won with the moral intensity of purpose and an affectionate sacrifice, which all true naturalists give to their work. The field of science, in other words, is not a great farm on whose broad acres the tiller rears a great store of grain: it is a garden where loving care may give the richest possible return of beauty and delight.

It is important to those who would undertake the unprofessional study of nature that they should disabuse their minds of the notion that science can only grow where there are great laboratories and teachers of much repute, and that the study of it must begin far away from the familiar things of life. As long as this notion prevails, it will be impossible to bring the scientific motive into the possession of most men. The truest fact of science is, that it does not depend upon its store of knowledge, but does depend on the way in which men seek for that knowledge. If every man could be brought into the habit of approaching his daily tasks, be they of the humblest trade, with a desire to see why the conditions about him were what they are, all men would have the scientific spirit instilled into them; and in their ordinary lives, with thought which was merely the most wholesome accompaniment of action, they would win their way to all that which is most precious in a life of pure research. If a boy, when setting about a trade, could be taught to go backward from the simple experiences of eye and hand until he saw some long perspectives in the nature with which he dealt, if he could be trained to watch for every indication of the unknown, and diligently seek the explanation of it, the end would be won, and all men would be students of nature; for as soon as the mind begins to ask why these things are so, and as soon as it learns by observations where experiment can be applied to go beyond the bounds of knowledge, a kindly, sympathetic relation with the world is established.

It seems that, if science is to be made the common property of men, we must accomplish the result by creating a spirit of inquiry, and applying it to the work which men have to do in their daily routine. The way to accomplish this task is doubtless the most important question which the world now has to face, for on the reconciliation of man with nature clearly depends the largest advance which is now possible to our kind. The only way to bring this result about is by giving men a great part of their education in connection with the work which they have to do in life. Our present theory is, to take youths, boys or girls, teach them first the rudiments of speech, literature, and mathematics, or, in other words, the common foundation of our education, and then give them a few years devoted to the acquisition of extremely miscellaneous information, which serves in a measure for instruction and in some small share for enlargement of the understanding. There is no question that this second stage of the education, that of miscellaneous instruction, is better than no training at all; but the result is, that in most cases the youths come to their occupations in life quite unprepared to take up their labor with the spirit of inquiry. At the most, they will go to books for knowledge; they will never awake to the sense that each man should be an inquirer, incessantly devoted to the task of understanding the world with which he comes in contact.

An education designed to bring men into closer relations with nature must be so contrived that the body of their training comes into close connection with the occupation which they are to follow. Let us suppose that, at fifteen years of age, it could be determined that the boy is to be a farmer, is to pursue any manufacturer's calling, or engage in any specified work in life. It seems to me that as soon as the youth has compassed the necessary rudiments of an education, has been informed concerning the mere outlines of history, and given some sense of the greater works in his own literature, he should enter upon a training for his vocation. In that work, his education should, as far as possible, proceed in an experimental manner. Beginning with the gross fact which comes to his attention in the actual pursuit of his occupation, he should be taught as far as possible to work backward towards the history and theory of his art. It will, of course, be necessary to teach him the general outlines of chemistry before he begins the study, for instance, of the chemistry of agriculture, and the general principles of physics and dynamics must precede the special problems in any branch of engineering; but the instruction, however wide-ranging, and it will be necessary to range over a very wide field, should always be directed as far as may be to the ends of teaching him how to think and inquire in the process of his daily labor.

(*Concluded next number.*)

[Original in *Popular Science News.*]

NATURAL HISTORY NOTES.

BY DR. S. F. LANDREY.

English-Sparrow Ingenuity. — At the city of Lafayette two summers ago, some boys, in flying a kite, dropped it accidentally over a telegraph wire, whence the string hung down several feet in mid-air. A female sparrow coveted the string to weave into her nest. She pecked at it, on the wing, several times unsuccessfully, and at last succeeded in getting one foot and leg entangled. It proved to be a painful and precarious situation. In vain she fluttered and tried to escape. Her calls were soon answered by nearly a hundred sparrows, which sat in rows chirping, occasionally flying down to the imprisoned bird near enough to understand the situation. At length, as if by preconcerted agreement, they started in a circle round the fettered bird; each bird with the certainty of a well-aimed arrow nipped the string with its bill. Finally the string parted suddenly; the prisoner nearly touched the ground before she recovered herself from the fall. She flew to an adjoining building, where her mates and herself soon loosened the obnoxious string, and she flew with it to her nest. Several hundred men and boys stood admiring witnesses of the untrained performances of these so-called mischievous birds. Suggestions of instinct, reason, perseverance, etc., fell from admiring lips; but the question, "Was it reason?" remained unanswered by those who allow to men only this high prerogative. As he is only concerned with *facts*, it is not the writer's province to answer that question. Sufficient to know that "not a sparrow falls to the ground without *His* care."

Cunning of the Fox. — On the Lower Wabash a company of hunters from Tippecanoe County encamped for the night among the cavernous limestone hills occasionally found in those regions. The hounds soon traced up the retreat of an old gray fox and her family in one of those narrow crevices that probably led into a more open cavern farther in. The whining of the young foxes was very distinct, and led to louder bayings of the hounds. The mother, however, was "not at home." But it was not long till her barking was heard beyond the camp, on a small hill in another direction. The dogs soon took the hint, and gave her a magnificent chase around the hill. Doubling on her track she deluded the dogs, returned to her cubs, and either carried or induced them to follow her into the deeper recesses of the cavern, beyond the dangers of digging and chasing. I have often thought that little piece of strategy a masterly piece of generalship. What could be more natural than to desire to draw away from her young ones the threatening dogs and men? Seeming to know that her own barking would have the desired effect of diverting their attention to larger game in an open field, she ventured to draw their attack upon herself, and succeeded in saving the lives both of herself and her young ones.

Electrical Lights. — The Jenny electrical light is in use in Logansport, Ind. Some peculiar facts are noticeable resulting from their use. They attract during the warmer weather all manner of nocturnal beetles, moths, and other insects. These are destroyed by thousands, for they find their way inside the open globes, and the intense heat destroys them. Some new and unusual insects are thus caught that one might look for in vain without this kind of a light.

Where a light hangs opposite a window, the most beautiful frescoings on an opposing wall may be discerned by letting the light shine, in full, through a pane or plate of glass. Every molecular fibre, spot, and variation will be magnified in a wonderful manner. The alternate lights and shades produce a magnificent picture for study.

Tyndall first demonstrated that darkness is produced at the uniting line of two lights. Two electrical lights distantly situated with respect to each other will produce midway — or, if one be stronger than the other, at the appropriate distance from each — a dark space.

So intensely brilliant is the light, that smoke, vapor, and ordinarily invisible bodies, cast deep, dark shadows to great distances, — greater even than it would be safe to say to one who had never seen them. Against the sides of barns, houses, and other buildings, — intervening trees, their branches and foliage, are not dimly, but neatly and plainly, shadowed. The usual flickering, increasing and decreasing, of this class of lights, is mainly due to lack of power or to imperfectly compositioned carbons.

Do Worms fall during Showers? — After some rainfalls, angle-worms are occasionally found in crocks or other vessels placed under trees or roofs of buildings, where certain birds, as robins, have a short time previously deposited them, or left them suddenly, by an attack from jay-birds, or being scared away by boys throwing at them, or shooting at them with their "flippers." If under a tree, or even in a clear space, the worms would be dropped at once into the vessels; and as they are smooth inside, on account of the glazing, the prisoners would have to remain. If left sufficiently long, they sometimes die and dry up in these locations; but if dropped on a roof, and the roof is old and mossy, they find lodgement under spots of old moss or under the ends of spongy shingles, where they remain till the rain induces them to crawl out and be washed down over the drip, or sometimes through pipes into closely cemented cisterns. Children, playing, often put such objects in out-of-the-way places, to see if they will swim, or to tempt some bird to procure his dinner. I never knew but one or two extensive rainfalls that were prolific in fishes, worms, etc. When about eight years old, there happened, near Dayton, O., what the "oldest inhabitants" called a "cloud-burst," which in after-years I discovered to be a water-spout formed over Stillwater River, at the milldam. The water — fishes, crayfishes, and every thing therein contained — was bodily lifted out of the river, carried something over a fourth of a mile, above a piece of intervening timber, and suddenly collapsed, depositing its catch, and all the water, on the turnpike. Great trenches were washed out, eight to ten feet in depth; and on the outer edge of the break was a large collection of catfish, bass, and other water inhabitants. I gathered up some of these myself, some of nearly a pound weight, and took them home.

In after-years I witnessed one of these "cloud-bursts" in broad daylight, when the fishes were there again, and all the mystery of it was cleared away. The deceiving little "whirlwinds" often seen on hot summer days convey a very good idea of the lifting power of the air when contending currents form one of those "lifting spirals," and carry up into mid-air dust, leaves, fodder, — in fact, any thing almost that "falls in" when the order comes "to go."

The London *Globe* says: "It is comforting to find that the boiling-point of 'allylenedichlordibromide' is 190°, while that of 'methylchlordibrompropylcarbinylchloride' is something between 140° and 145°."

[Original in *Popular Science News.*]

BOTANY AS A RECREATION.

BY FREDERICK LEROY SARGENT.

III.

In the study of sea-weeds one can make a very good beginning, even to the recognition of species, without any aid from the microscope. Every one who has been at the sea-shore must have some idea of the beauty of these plants, but only those who have collected them and studied them have obtained any adequate conception of their exquisite delicacy. The best introduction that a beginner can have is afforded by Hervey's *Sea Mosses*, a delightful little book, adapted to the needs of those who know nothing whatever of botany, giving full directions for practical study, and illustrated by accurate colored plates. For more advanced work on this group the student will need Farlow's *Marine Algæ of New England and Adjacent Coast;* microscopical details are illustrated by plates.

The fresh-water algæ are almost always microscopic, and in their study one feels as if he were peering into a new world. He sees an endless variety of form, some beautiful in their simplicity, others amazing in the intricacy of their ornamentation. It is a series of surprises. Mostly invisible to the naked eye, there may be collected in a spoonful of water enough of these tiny plants to furnish material for days, or even weeks, of delightful study. In many cases their study is not difficult, even for the novice. Stokes's *Microscopy for Beginners* forms an excellent introduction, and at the same time serves as a useful guide in the recognitiou of the minute animals often associated with these lower plants, and not infrequently liable to be mistaken for them. A thorough study of these plants will require the use of Wolle's *Desmids of the United States*, and *Fresh-Water Algæ* (exclusive of the desmids) by the same author.

The group of diatoms is not treated in the works above mentioned, except in an elementary way by Stokes. The diatoms present peculiar difficulties, and there is no general work in English to which the student may be referred. Kain's photographic reproduction of the plates of Schmidt's *Atlas der Diatomaceenkunde* will be found very valuable for those who wish to study the species of these exquisite creatures.

The fungi are as numerous as they are difficult to study; and although in certain groups familiarity with one species may be obtained without a great deal of trouble, in the majority of cases the student can hardly hope to gain more than a general knowledge, unless he is prepared to devote considerable time to the subject, and is able to use a number of books, not only in English, but in French, German, and Latin. However valuable and interesting this may be, we are loath to stretch our idea of "recreation" so as to include such work. We lack good general books on American fungi (at least in English), and about all we have are synopses of a few of the smaller groups scattered through State reports and botanical journals. A *List of Works on North-American Fungi* has recently been issued by Professors Farlow and Trelease, and to this we may refer those who desire information.

The lichens are also, we must confess, a difficult group; but we are fortunate in having valuable aids provided for the American student. Willey's *Introduction to the Study of Lichens* offers all needed preliminary informatiou regarding technical terms and methods of collecting and examining, while Tuckerman's *Synopsis of North-American Lichens*, although not yet completed, includes the great majority of forms that a beginner would be apt to collect.

While it is, of course, not to be expected that any one will attempt to gain proficiency in all of

these departments, a good general knowledge of the vegetable kingdom is quite within one's reach, and is important for all students of botany, no matter in what department they are especially interested. During the last few years there have appeared several excellent books, which are intended to give students this general view. It will suffice to mention of these Bessey's *Botany for High Schools and Colleges* and Goebel's *Outlines of Classification*. The former is the more elementary, while the other is much fuller, and embodies the latest views of the most eminent botanists.

One who begins the study of botany to-day may enjoy many advantages which could not be looked for by the student of ten years ago. Not only is this the case in the matter of books, but it is also true in the matter of personal assistance from botanists. We do not refer merely to the increased educational advantages of our various schools and colleges, but more especially to a source of help which may be enjoyed alike by all who wish to learn. We mean the advantages of the Agassiz Association, whose influence is reaching over the whole of our country and beyond, and to which all who study nature are welcome. In the Handbook of the Association appear the names of a number of specialists who have offered to assist beginners by directing their study, or answering questions, or naming specimens pertaining to the departments of science in which they are engaged.

Closely connected with the study of systematic botany is the formation of an herbarium, or collection of preserved specimens. A great deal of very profitable work may be done, undoubtedly, without any collection, and it must be admitted that the pressing and drying and mounting and labelling of any considerable number of specimens soon becomes drudgery rather than recreation. Still, thorough study involves frequent comparison with preserved specimens, and an herbarium becomes a necessity if one is to do more than elementary work. In many of the books already mentioned, the methods of collecting and preserving specimens are more or less fully described. For a good general work giving the most approved methods of treating specimens of all the different groups, the student is referred to Bailey's *Collector's Handbook*.

(Concluded next number.)

GOVERNMENT MEDDLESOMENESS.

In the United States, the recent action of the French Government in providing that nothing shall be bought for public use which is not of domestic production, and which the outside world has regarded as a policy unworthy of an enlightened nation, has had its counterpart and precedent in the previous legislation of quite a number of the States, with this exception, that in France the discrimination is made against foreigners only, while in the United States the discrimination is made against their own countrymen living in different political divisions of the country. Nothing, moreover, can probably be found in Europe to parallel the recent legislation of one of the leading States of the Northwest (Minnesota), and a large part of which was the work of a single legislative session (limited to sixty days) in 1885, and which has thus been described by a recent writer: Prominent in importance were statutes providing for the weighing, handling, and inspection of grain, the construction and location of grain-warehouses, the providing of cars and side-tracks by railroads, and the regulation of rates of transportation. Next was legislation respecting State loans of "seed grain" to farmers whose crops had been ruined by grasshoppers; for the subsidizing of State fairs from the State treasury; for enabling farmers to avoid the payment of a portion of their debts; for protecting butter-makers from the competition of artificial products, such as "butterine;" for regulating the details of the cattle industry to the extent of registering and giving State protection to brands and other modes of identification, and of stamping out contagious diseases with small courtesy to the rights and wishes of individual owners; and for regulating the lumber-business to such an extent, that not a log can float down a stream to the sawmill for which it is destined without official cognizance. One State Board regulates the practice of medicine and the admission of new practitioners; a second the examination of druggists and compounding clerks, as precedent to entering into business; while a third regulates the practice of dentistry. Various enactments prescribe the toll to be exacted for grinding wheat; when one man may slay his neighbor's dog with impunity; how railway companies must maintain their waiting-rooms at their stopping-places for passengers; the hours of labor, and the employment of women and children; the maximum time for which locomotive engineers and firemen may be continuously employed; what books shall be used in the public schools; forbidding "raffles" at church fairs under "frightful penalties," and making it a crime to give away a lottery-ticket, and a misdemeanor "to even publish an account of a lottery, no matter when or where it has been conducted." Among bills introduced, and which found considerable support, but were not enacted, was one forbidding persons of different sexes to skate together, or even be present at the same hour on the rink floor, and another to license drinkers, which provided that no person should be permitted to use intoxicants or purchase liquors of any kind without having first a public license. — *From "Economic Disturbances since 1873," by* Hon. David A. Wells, *in Popular Science Monthly for January.*

INTERESTING DISCOVERIES AT POMPEII.

Some interesting discoveries have recently been made in the excavations at Pompeii. Many silver vessels and three books were found under conditions which lead to the conclusion that the owner of those valuables, a lady named Decidia Margaris, had packed them at the moment of the catastrophe in a cloth, in order to save something more than mere naked life, but that she perished in the attempt. Her name we learn from the books, important documents, and title-deeds, which she would not leave behind. These are the usual wood tablets, eight by five inches, coated with wax, and several of them are fastened together in book form.

For the first few days after their discovery they were perfectly legible, except in a few places where damp had destroyed the wood; after that time, probably because the wood began to dry, the layers of wax peeled partly off, splitting up into small portions. The contracts are all between the owner mentioned and a Poppæa Note, a liberated slave of Priscus; and from the names of the consuls referred to in two of them, the year (61 A.D.) may be fixed. In one of them Decidia buys of Poppæa two young slaves, Simplicua and Petrinus; another also has reference to a sale of slaves; the third contract mentions a sum of 1,450 sesterces, which Poppæa Note undertakes to pay to Decidia Margaris in case the slaves should not turn out profitable.

The silver plate of Decidia formed a set for four persons; but, as it was gathered up in haste, it is incomplete. It comprises four goblets with four trays, four cups with handles, four smaller cups, four others, four cups with feet, a cup without a handle, a filter, a small bottle with perforated bottom, a spoon, and a small scoop. The total weight of the articles is 3,943.70 grams (not quite 127 ounces troy). There was also found a silver statuette of Jupiter on a bronze dish with raised edge, and inlaid with a finely chiselled silver plate; and, finally, three pairs of ear-pendants. — *Builder and Woodworker.*

SCIENTIFIC BREVITIES.

Volume of the River Rhone.— It has been estimated that the amount of water passing into the Lake of Geneva is about eighteen hundred cubic feet per second. At this rate it would require about fifteen years for the river to fill with water the basin occupied by the lake.

A Submarine Meteorite. — What is believed to be a meteorite has just been dug out of the ferry harbor of Nökjobing, in Denmark. The stone, which weighs about half a ton, was found in soft mud, and no other stones were near it. It is very dark in color, contains iron, and is of unusual weight for its size, the work of moving it being very laborious. It has now been blasted to pieces, which will be examined scientifically.

Variation in Mountain Heights.— The Cordillera of the Andes has for some time been exhibiting a curious phenomenon. It results, from observations made upon the altitudes of the most important points, that their height is gradually diminishing. Quito, which in 1745 was 9,596 feet above the level of the sea, was only 9,570 feet in 1803, 9,567 in 1831, and scarcely 9,520 in 1867. The altitude of Quito has therefore diminished by 76 feet in the space of 122 years. Another peak, the Pichincha, has diminished by 218 feet during the same period, and its crater has descended 425 feet in the last 25 years. That of Antisana, has sunk 165 feet in 64 years.

Turbidity of Water.— Dr. C. O. Harz describes a peculiar appearance in the water of the Schliersee, Bavaria, commencing when it was covered by ice, — a dense turbidity, at first of a green or blue tinge, but becoming finally yellow-red or peach-colored before finally disappearing. This was due to enormous quantities of a palmella, which was attacked and finally completely destroyed by a peach-colored micrococcus.

Prehistoric Skating.— As is well known, the art of skating is a prehistoric one. In many parts of Europe bones of domesticated animals have been found which had been used as skates or as runners of small sledges. It is of considerable interest to learn that similar implements are found still in use in several parts of Northern Germany. In the *Journal of the Berlin Ethnological Society* sledges are described which consist of a board resting on the bones of a horse. But, besides this, skates are used the runners of which consist of the lower jaw of cattle, the curvature of the lower side serving admirably the object of the skate.

Naturally Reduced Iron.— On the North Saskatchewan River an almost horizontal bed of lignite may be seen cropping out at intervals in the river-bank for several miles, overlaid by dark gray clay-shales and gray and yellow soft argillaceous sandstones containing nodules of clay ironstone, containing 34.98 per cent of the metallic iron. The seam of lignite has been completely burned out over a considerable area, leaving the surface covered with a bed of *débris* of ashes, clinkers, and burnt clay, in places to a thickness of twenty feet, supporting at present a thick growth of grass and underbrush. From this mass of burnt clay and cinders, pieces of metallic iron can be readily picked out, weighing in some cases as much as fifteen or twenty pounds, doubtless derived from the nodules of ironstone mentioned above, which have been reduced to the metallic state by the heat caused by the burning of so large a body of lignite.

Practical Chemistry and the Arts.

A ROTARY THERMOMETER.

This ingenious instrument is described in *La Nature*, and is the invention of M. Rabinovitch. It is quite sensitive to small changes of temperature, and, if desired, registers the highest and lowest points reached in a given time, or draws automatically a curve on a sheet of paper, showing all the variations. It will also sound an electric bell when any desired temperature is attained.

The general appearance of the instrument is shown in Fig. 1, and the details of its very

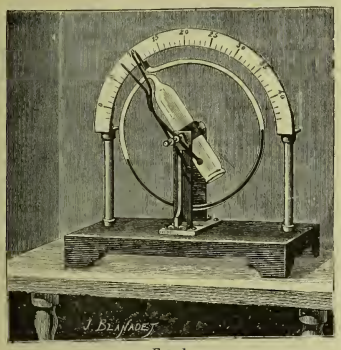


Fig. 1.

simple mechanism in Fig. 2. The main reservoir or bulb, *a*, is filled with alcohol; while the curved tube, *bb'*, into which it is drawn out, contains mercury. As the temperature rises, the alcohol expands, forcing the mercury along in the tube, and so changing the centre of gravity as to cause the whole to revolve on the central pivot, *c*, to which it is attached. The metallic index, *h*, which is placed at the end of the tube, thus indicates on the scale, *ii*, every variation of temperature.

Two extra pointers, *d* and *e*, are pushed in either direction by the revolving tube, and

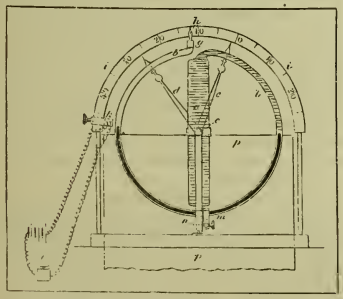


Fig. 2.

indicate the highest and lowest points reached in any given time. At *k* there is an electric connection, which can be moved along the scale, and is completed by the metallic pointer, *h*, causing a bell to ring at any temperature to which it may be set. At *m* a piece of metal, carrying a pencil, *n*, is attached to the tube; and if a sheet of paper, moved by clockwork, is made to pass before it, a tracing will be made which will show all the variations of temperature during any given time.

The simplicity and cheapness of this instrument are also among its most important advantages; and, if placed upon the market, it would doubtless find a ready sale.

A SIMPLE METHOD OF ILLUSTRATING CHEMICAL EQUIVALENTS.

Professor Torrey, in a recent number of the *American Chemical Journal*, describes a simple method for showing to students in elementary chemistry the difference in the atomic weights of different metals, and determining these weights with approximate accuracy. He writes: —

"While the freshman class were studying the action of hydrochloric acid on metals, it was noticed by some of them that some metals apparently liberated more hydrogen than others. This observation aroused considerable interest, and I thought it would be well to introduce the equivalent then and there.

"The question was put as follows: *What weight of each metal will it take to liberate one milligram of hydrogen?*

"The metals chosen for experiment were iron, zinc, and aluminium. The apparatus given to each student consisted of a three-inch evaporating dish and a common six-inch test-tube. In some cases graduated gas-tubes were given out. Fifty to a hundred milligrams of the metal having been accurately weighed, the test-tube was filled with acid (in most cases hydrochloric acid), and inverted in the evaporating dish, previously one-third filled with the same acid. The piece of metal was now quickly brought under the tube, and the whole apparatus left to itself till the solution was complete. Sometimes a gentle heat was applied. Later on, it was found better to put the metal in a little cup (made by cutting off a half-inch from the lower end of a small test-tube) before bringing it under the tube, thus avoiding the possibility of bubbles being carried out by the descending current of acid. When solution was complete, the tube was transferred to a large jar of water, and the acid displaced by water. It was then cooled to the temperature of the room.

"When graduated tubes had been employed, the volume could then be read directly, the necessary corrections for temperature and pressure made, and the equivalent deduced. When ordinary test-tubes had been employed, the line where gas ended and water began was marked on the tube by tying a piece of fine thread round it. Water was then run in from a carefully graduated burette, till the space previously occupied by gas was occupied by water. The volume thus obtained represented the volume of gas obtained, and was corrected for temperature and pressure as usual.

"I acknowledge the apparent crudeness and roughness of the process, but invite attention to the following results: —

Iron.	Zinc.	Aluminium.
28.2	32.68	9.006
27.8	32.65	9.004
27.69	32.46	9.004
27.78	32.36	9.000

"It should be said that the level of the water in the tube was always brought to the level of the water in the jar before reading the volume, and that the tube was left standing long enough to get to the temperature of the room after being placed in position."

A GELATINE BATTERY.

A gelatine cell has been designed for use in situations where it is desirable to have a battery which shall be able to withstand violent shaking and jarring without deterioration. There are several points of interest in the process of manufacture of this cell, which has been patented. The gelatine is prepared by soaking Irish moss, or other sea moss, in cold water until it becomes softened by absorption, and allowing it to soak until the starchy matter of the plant begins to ferment or sour. When it reaches this stage, a quantity of water about equal in bulk to the soaked moss is added, and the whole boiled for from fifteen to thirty minutes. The amount of water may, however, vary according to the desired consistency of the final product. After the boiling, a quantity of sal-ammoniac or other salt of an alkali is added, sufficient to make the excitant a good electrolytic conductor, and to assist in the exciting action in the zinc, and the mass is then subjected to further boiling. These repeated boilings serve to completely rupture all the starch-cells of the plant, and dissolve the gluten, while the fermentation probably assists in decomposing the cellulose. The material then becomes of a uniform pasty consistency, and the sal-ammoniac is thoroughly incorporated and dissolved throughout the mass. The latter is poured into a receiving-vessel, and a small quantity of bisulphate of mercury is added. The latter improves the electrolyte by slightly acidulating the same, and keeps the zinc amalgamated. The mass is then allowed to cool, when it is packed in the battery jar between and around the electrodes. It becomes of a comparatively stiff, pasty consistency, and preserves the electrodes in place, however much jarring the battery may be subjected to. The inventor states that this electrolyte resists low temperatures, and that during use more or less fermentation goes on, preserving the acidulation, and tending to raise the electro-motive force. — *Mechanical World.*

MODERN EXPLOSIVES.

The composition of some of the modern high explosives, according to *Engineering*, is as follows: —

Dynamite: 75 parts of nitro-glycerine and 25 of infusorial earth.

Dualine: 80 parts nitro-glycerine and 20 of nitro-cellulose or gun-cotton.

Rendrock: 40 parts nitro-glycerine, 40 of nitrate of potash or soda, 13 of cellulose, and 7 of paraffine.

Giant Powder: 36 parts of nitro-glycerine, 48 of nitrate of potash or soda, 8 of sulphur, and 8 of resin or charcoal.

Mica Powder: 52 parts nitro-glycerine and 48 of pulverized mica.

Tonite: 52½ parts of gun-cotton and 47½ of nitrate of baryta.

Blasting Gelatine: 92 parts of nitro-glycerine and 8 of gun-cotton.

Atlas Powder: 75 parts of nitro-glycerine, 21 of wood-fibre, 2 of carbonate of magnesia, and 2 of nitrate of soda.

Rackarock: 77.7 parts of chlorate of potash, and 22.3 of nitro-benzol.

It will be noticed that nearly all the above explosives are composed principally of nitro-glycerine; and it is probable that in most cases the other ingredients only act as absorbents of this liquid, and really add nothing to the explosive power. The decomposition of nitro-glycerine is practically instantaneous, and the slower-acting nitrates and hydrocarbons must be left far behind when the

mass is exploded. The power of all these substances is due to the paradoxical element nitrogen, which is by itself the most neutral and inactive of all the elements, but, when forced into chemical combination, usually confers an element of weakness upon the entire molecule of which it forms a part.

THE FLIGHT OF BIRDS.

At a meeting of a scientific society last fall, Professor W. P. Trowbridge read an interesting paper on the above subject.

It has always been a puzzle how the muscular action necessary to keep birds on the wing so long as they often remain could be possible; and Professor Trowbridge explained the recent discovery by his son, which is, that birds of prey and some others have the power to lock securely together those parts of the wing holding the extended feathers, and corresponding to the fingers of the human hand. The action of the air on the wing in this condition extends the elbow, which is prevented from opening too far by a cartilage, and the wings may keep this position for an indefinite length of time, with no muscular action whatever on the part of the bird. While resting in this way, the bird cannot rise in a still atmosphere; but if there be a horizontal current, it may allow itself to be carried along by it, with a slight tendency downward, and so gain a momentum by which, with a slight change of direction, it may rise to some extent, still without muscular action of the wings. The professor also believed it quite possible for a bird to sleep on the wing. In discussing this paper, Professor J. S. Newberry said that he had once shot a bird which came slowly to the ground as if still flying, but reached it dead. He believed that it had died high in the air; but he had never been able to account for the manner of its descent till now, when he found an explanation in the statement of Professor Trowbridge.

LEVYING DUTY ON ELECTRICITY.

An odd story is told of a customs collector having vague ideas about electricity. It appears that at St. Stevens, New Brunswick, there is an electric-light station, from which wires are led over the St. John's River to Calais in the States. The collector of customs on the southern side took it into his head that this conveyance of the electric light into his district ought to be charged the same as other commodities. He accordingly sent to the secretary of the treasury to ascertain the amount of duty chargeable on the electricity. This was a poser for the secretary, who, after studying the matter carefully, replied to the officer to the effect "that electricity is not dutiable, being an invisible and subtle agent of power, possessing no substance as a merchantable commodity." In future this mysterious "fluid" may be carried all over the country, notwithstanding the desires of customs officials.

LABORATORY NOTES.

To Preserve Rubber Tubing.— Very elastic caoutchouc tubing gradually loses some of its elasticity. Later the tubes break on stretching, even if previously laid in warm water; and finally they crack if pressed between the fingers. This change has been attributed to a very slow formation of sulphuric acid by the action of moist air on the sulphur contained in the caoutchouc. By frequent washing with slightly alkaline water, the action of the acid is prevented. Tubes washed five or six times a year remained perfectly elastic.

Explosion of Ether. — The *Moniteur de la Photographie* of Paris calls the attention of chemists to a dangerous explosion of ether which occurred whilst this liquid was being carefully evaporated in a platinum dish, after having served for extracting grease. The ether was very old, having been kept in a stock bottle for many years, and probably exposed to the light. It contained no less than five per cent of peroxide of hydrogen, to which the explosion is ascribed, and a little acetic and formic acid.

Explosive Ice. — A most unusual phenomenon, which occurred in the laboratory of the University of Virginia, has been described by Mr. Mallet, the professor of chemistry of that establishment. During a severe frost, ice was formed in the glass vessel of a gazogene, the familiar apparatus for charging water with carbonic-acid gas. The expansion of the ice burst the vessel, after which the ice itself exploded repeatedly, and threw off fragments, with a crackling sound. The effect is attributed to the pressure of the gas contained in the ice, which, in the case of water, would appear as simple effervescence.

Remedy for Frothing in Distillation. — Distillers on a small scale, particularly operators in the laboratory, are often much annoyed by the occurrence of frothing. The pharmacist H. Kung has recently proposed a valuable remedy for this. He states that paraffine acts very effectually in preventing the frothing which generally occurs in decomposing ammonia salts by means of lime or magnesia. Two or three grams of paraffine are said to be amply sufficient in this respect for an Ehrlenmeyer flask of eight hundred cubic centimeters capacity, and containing between two and three hundred cubic centimeters of solution. The same inert substance may be found applicable in a variety of similar cases, and so prevent annoyance and loss to the operator.

A Current Indicator. — An ingenious indicator of excessive currents has been devised by Mr. Crookes. It consists of a flat coil of thin wire painted with a paint of a red color so composed as to change color under heat; around this a screen is placed coated with ordinary red paint of the same shade. Coils of thick wire are placed in parallel circuit with the thiu wire coil, and their resistances so adjusted, that, by setting a commutator, the point at which the indication of an excess of current takes place can be varied to suit different requirements. When a current is passed through the instrument, the thin wire becomes warm; and when the current is in excess of a definite predetermined quantity, the color changes from red to black. On cooling again, the paint resumes its former hue.

INDUSTRIAL MEMORANDA.

A New Iron-smelting Process. — The British vice-consul at Moscow reports a new process for producing iron and steel direct from the ore, which has recently been invented and patented by a Russian engineer. The vice-consul says: "The whole secret of the process lies in the construction of the furnace, which is simple and inexpensive. It will be difficult for our iron-masters to believe that, under the new process, iron ore, after submitting it to the ordinary smelting process, is taken direct from the furnace to the rolling-mill, and turned iuto thin sheets of the finest charcoal iron; yet such is certainly the case, there being, to my positive knowledge, three such furnaces in this country working with perfect success. There can be but little doubt that the new invention will create quite a revolution in the manufacture of charcoal iron. Whether the process can be applied with equal success where coke is the fuel, I cannot positively assert, as the furnaces I refer to are fired with charcoal. I am, however, assured that an experiment has been made with coke, and was crowned with equal success."

The Action of Nitrogen on Iron. — Mr. H. N. Warren has subjected specimens of fine merchant iron to the action of nitrogen in ammonia gas while at a bright-red heat, and found that, on cooling, it showed an intense white surface, with increased hardness. Its fracture was crystalline, and resembled that of siliconized steel. It also showed the presence of nitrogen under analysis, through the formation of ammonia. Copper bars also showed similar changes when subjected to nitrogen in the same way. Some of the bars split up on being brought into the atmosphere before they were cold. Mr. Warren thinks this phenomenon due to their absorption of ammonia while heated, and expulsion of it when cooled,—an effect similar to the absorption of oxygen by silver.

Iron-Brick Paving Stones. — Paving blocks called iron-brick are now being introduced in Germany. This brick is made by mixing equal parts of finely ground red argillaceous slate and finely ground clay, and adding five per cent of iron ore. This mixture is moistened with a solution of twenty-five per cent sulphate of iron, to which fine iron ore is added until it shows a consistency of 38° Baumé. It is then formed in a press, dried, dipped once more in a nearly concentrated solution of sulphate of iron and finely ground iron ore, and is baked in an oven for forty-eight hours in an oxidizing flame and twenty-four hours in a reducing flame. The German government testing laboratory for building-materials has reported favorably on this brick.

To Repair Stonework. — Make a paste of silicate of potash and hydraulic cement, and add half its weight of very fine sand. This adheres perfectly to stonework, and soon becomes very hard and durable. It is especially applicable to stone steps which have become worn from use.

Salt-Water for Cement Mortar in Germany. — German experiments designed to ascertain the effect of frost upon hydraulic mortars and cements gauged with and without the addition of salt to the water have been quoted in the *Revue Industrielle*. Cubes of stone six cubic centimeters in area were used in these experiments, and were joined together with cement mixed with water ranging from pure rain-water to water containing from two to eight per cent of salt. While the cement was yet fresh, the blocks were exposed in air at a temperature of 20° to 32° F., after which they were kept for seven days in a warm room. At the end of this time the specimens were examined. The cement made with pure water was quite crumbled, and had lost all its tenacity. The cement mixed with water containing two per cent of salt was in better condition, but could not be described as good; while that containing eight per cent of salt had not suffered from its exposure to the low temperature.

Cheap Method of Platinizing Metals. — In this new process the metallic object is covered with a mixture of borate of lead, oxide of copper, and spirits of turpentine, and submitted to a temperature of from 250° to 330°. This deposit, upon melting, spreads in a uniform layer over the object. Then a second coat is laid on, consisting of borate of lead, oxide of copper, and oil of lavender. Next, by means of a brush, the object is covered with a solution of chloride of platinum, which is finally evaporated at a temperature of not more than 200°. The platinum adheres firmly to the surface, and exhibits a brilliant aspect. If the deposit be made upon the first coat, the platinum will have a dead appearance. Platinizing in this way costs, it is said, about one-tenth the price of nickel plating.

Home, Farm, and Garden.

HOUSEHOLD HINTS.

As already stated in the *News*, recent investigations render it doubtful whether "sewer-gas" is in all cases so dangerous to health as zealous sanitarians have urged; but that the emanations from sewers are sometimes, if not often, poisonous, cannot be doubted. Serious if not fatal consequences have occasionally been due even to the indirect influence of these pernicious gases. Persons have sometimes been poisoned from eating food that had been exposed to the effluvia from a sewer. Cases have been known in which the waste-pipe of a refrigerator communicated directly with a sewer, affording perhaps the readiest means for the escape of gases therefrom.

It is a familiar fact that milk is a singularly favorable vehicle for receiving and transmitting infection, and on this account special care should always be taken to keep it in a clean and well-ventilated place. Foul and ill-smelling emanations are rapidly absorbed by the surface of the fluid, and the development of noxious organisms is liable to follow. Even if this secondary evil result does not ensue, the taste and odor of the milk are rendered more or less offensive.

Infants are naturally sensitive to the mischievous effects of milk which has become contaminated in this way; disease and death are not unfrequently the consequence. If the milk is pure, and kept in a proper place, it may be rendered poisonous by the use of feeding-bottles which are not clean and sweet. Lactotoxine and other dangerous ptomaines may be formed in the decomposition of remnants of stale milk in various parts of the apparatus, — some forms of which are apparently designed with special ingenuity to render a thorough cleansing impracticable, — and the unlucky baby that has to put up with this murderous sort of stepmother is the helpless victim, sucking poison, and perhaps fatal poison, with every mouthful of its daily food.

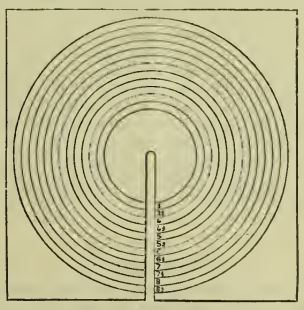
To turn to another familiar fact in household sanitation, the wholesome and beneficent influences of *sunshine* are known in these days to every intelligent person; and yet the bad old fashion of excluding the life-giving beams from our houses is too often followed. Perhaps the most common reason for this is the fear that the direct sunlight will fade the carpets; but our own observation and experience have satisfied us that the danger of injury from this cause is greatly exaggerated by housekeepers. We have known carpets of various kinds — ingrain, brussels, Wilton, etc. — and of almost every combination of colors to be freely exposed to the sunshine from one year's end to another; and in nine cases out of ten the portions thus exposed were faded very little, if any, more than other portions. Certain colors, especially blues and browns — but even these only in exceptional instances — appear to suffer more than others; but these same colors are apt to fade, though less rapidly, in diffused sunlight. We honestly believe, that, if our friends will test the effect of the sun upon their carpets, they will generally be surprised to find how well these endure the exposure. The same is true of most furniture coverings and upholstery materials of all kinds, except with aniline dyes, which are singularly fugitive in direct sunlight, even when they bear diffused light tolerably well for a long time.

The mention of upholstery reminds us of a minor hint which may be useful to many of our friends in these days, when portières have so commonly taken the place of inside doors. We were amused the other day in hearing a lady dilate upon "the *dreadful* time" she had with the portières in a new seaside cottage last summer." The things would not work, and the servants had to take a broom-handle sometimes to slide the rings on the poles." We told her that, when we had had similar trouble, it occurred to us to try the effect of occasionally wiping the pole lightly with an oily rag. This worked like magic, and the refractory rings slid as easily as an urchin on the ice these zero days. Wipe the dust from the pole first, and the slightest film of oil answers the purpose: a few drops of sweet-oil on a rag or bit of soft paper are enough, and the dose need not be repeated for several weeks, whether the pole be of wood or brass.

We had in mind other little things of this kind, which, trivial though they be, have much to do with the comfort of the household; but we must leave them to another day.

A DEVICE FOR MEASURING BLOSSOMS.

The *Journal of Horticulture* illustrates a device by which the actual or comparative size of flowers can be quickly and easily measured. It consists of a piece of thin wood or pasteboard, on which a series of circles is drawn, with the diameter of each marked upon it. A slit is cut in this, extending to the centre; and to measure the diameter of a blossom, it is only necessary to pass the stem of the flower to the centre of the board, when its size can be measured at once by noting how many of the circles are covered by it. We think many persons will be surprised at the difference between the apparent and actual size of many flowers.



DEVICE FOR MEASURING BLOOMS.

SCIENTIFIC FACTS FOR HOUSEKEEPERS.

The cooling effect of ice is actually dependent upon its melting, as in this process the heat which causes it to melt is absorbed from the surrounding bodies. A pound of ice in melting will absorb sufficient heat to cool a pound of water from 174° F. to the freezing-point, or to cool 142 pounds of water one degree.

The heating power of steam is due to the converse of this principle. A pound of water converted into steam, and passed into a radiator, will, upon condensing, give out enough heat to raise one pound of water, or about 4.2 pounds of air, from 32° to 1,(04°. Reducing these quantities to more familiar figures, a pound of steam will heat about 1,000 cubic feet of air, or a room ten feet square and ten high, from 32° to 80°.

Glass dishes crack when suddenly placed in hot water, on account of the unequal heating of the glass. It is a very poor conductor of heat, and the part first placed in the water expands before the heat can reach the other parts, thus causing a strain which results in its fracture. Very thin glass is less likely to crack from this cause, as the heat is more quickly transmitted. For chemical laboratories, where the glass vessels are exposed to great variations of temperature, they are purposely made as thin as is compatible with the requisite strength.

The pungent vapors which arise from an overheated frying-pan are due to the formation of a substance known as *acrolein*. It is formed by the destructive distillation of fats or glycerine, belongs to the class of substances called by chemists *aldehydes*, and has the formula C_3H_4O.

Another disagreeable substance is formed by the incomplete combustion of bodies rich in carbon, as oil or wax. It is known as *acetylene* (C_2H_2), and the suffocating odor of a smoky lamp or candle is largely due to this hydrocarbon. If the flame of a lamp is turned so high that the air passing through the chimney is not sufficient to cause a complete oxidation of the oil, *acetylene* will be formed in considerable quantity. It unites with copper to form an explosive compound, which is rarely deposited in brass or copper gas-pipes.

The property of liquid albumen (white of egg), of becoming coagulated at a certain temperature into an insoluble solid mass, is of great value in culinary processes. Coffee, jellies, sirups, etc., are clarified by mixing the albumen with them, and heating; all the fine impurities are enveloped in the coagulated mass, and can readily be removed by straining. By mixing the white of egg with sugar, beating to a froth, and then heating, the light, spongy mass, commonly known as *méringue*, is hardened and made permanent.

Yeast, although generally called a plant, is actually more closely allied to the animal kingdom. In these lower organisms the line separating the plant and animal is a very uncertain one. Fermentation cannot take place except between the temperatures of 41° and 86°, and

50° and 75° are the more usual limits. In processes of fermentation as the raising of bread, not only is carbonic-acid gas given off, which gives to the dough its lightness, but alcohol, and small quantities of glycerine and succinic acid are also formed. The loss of flour by the fermentation of the "raising" process has been estimated as high as ten per cent. The old question, Where did the first baker get his yeast? has never yet been answered, unless we accept the theory of spontaneous generation, as yeast, whether plant or animal, certainly contains the mysterious vital principle.

COLOR IN PLANTS.

At a recent meeting of the Edinburgh Botanical Society Mr. Sewell read a paper in which he showed, according to the *Gardeners' Chronicle*, that more or less intense color always accompanies the various degrees of imperfect vegetation. Spring and autumn tints come under the same explanation as flower colors, in that there is in each case a using-up of previously obtained material, not a predominance of the constructive elements throughout the cells.

Coloring in connection with reproduction may first be noticed among the cryptogams, where the reproductive parts of the plant are yellow or white their energy being spent otherwise than in producing chlorophyll for a vegetative function.

Mr. Spencer and Mr. Grant Allen have both pointed out that "incipient floral color is present in all imperfectly developed shoots," or "might be expected to appear in flowers because of their low constructive energy." Evidence of this was seen in caulerpa, where, though yellow when in drier, less nutritive habitats, it became green when grown in water, — a more nutritive condition. Foliage plants, as croton or such plants as *Arum maculatum*, have their color more intense when pot-bound or growing in less nutritive places; green takes the place of the color when grown under more vegetative conditions, as, for instance, when newly repotted by the florist.

It is where growth is locally restricted, as in the petioles of *Primula sinensis*, as on secreting surfaces of pitcher plants, or *Drosera*, or as in honey glands, that color tends to appear. A similar explanation accounts for the red tips of the daisy and pyrethrum; and for the appearance of new colors at the apex of the petals, as it is in the apex rather than the base or among the disk flowers that growth has most certainly ceased. We may similarly account for the predominately white color of winter flowers, because at that time of year all growth is sluggish: there is less actively destructive change from the primary yellow color. On the contrary, alpine flowers, growing where there is an open and sunny exposure, favoring high destructive change, are notably brilliant. Certainly there are not a greater number of insects in alpine than in lowland regions; nor is the explanation of white rather than red winter flowers to be found in the absence of insects which would select reds at that time, as has been suggested.

Changes of color during the life of the flower, as seen in *Convolvulus minor* or *Myosotis versicolor*, are but gradations of the natural series of changes observable with more or less distinctness as it occurs in greater or less degree in nearly all flowers. Such changes occur especially just before death. They are very noticeably caused by altered climatic conditions, as, for instance, where a cold and damp winter has been observed to be productive of white varieties, or a hot, dry summer of red ones. That white varieties of plants normally red or blue are products of changed or weakened constitution, is shown in the fact that such plants as white calluna or erica may be distinguished by the lighter green of their foliage, as well as by their flowers.

To explain such color variations as those of *Polygala vulgaris*, we do not need to agree with Dr. Taylor, who considers that the three colors of *Anemone patens*, for instance, "are three kinds of bait" which nature has provided, that the plant may be more certain of attracting insects. We may understand such varieties, if not of present origination, yet to have originated under different conditions of growth, which favored a more or less actively destructive constitution in the petals.

A labiate, not unlike *Salvia Horminum*, common in Thuringia, shows all the stages of this series of color-change in single plants. The flowers are yellow, whilst the bracts which terminate the floral axis are colored either yellow, red, or purple; the purple being produced at the extremity of the axis, whenever present, just at the place where, from checking the growth and exposure to the sun's rays, the character of the cell contents would be influenced most acutely.

Indeed, if we bear in mind these facts, agreeing with the assertion made by Mr. Spencer, that floral colors appear at the termination of the axis, we must differ from him in his further conclusions, "that this color tends to fade away, and is only prevented from disappearing by the action of natural selection."

More or less intense color appearing wherever vegetation is checked, we must expect accumulation of color in flowers as a necessary consequence of the reduction which is there taking place. It does not matter how this reduction is mainly brought about, whether by use, environment, or natural selection.

We see also that colors need not be held to be due to slow, indefinite variations, the cause of which remains unknown: it may be a very sudden variation brought about by climatic conditions, which sudden variations are far more likely to be noticed by insects than are very gradual changes of tint.

It does not need that we regard flower color as existing alone by virtue of the benefit it confers upon insects, any more than we allow older biologists to regard it as produced because of its moral effect upon mankind. It is the natural outcome of the tendency towards perfection in the reproductive part of the plant. It is a correlation necessitated by the lessened vegetation; and though undoubtedly of use to insects, which check or quicken the tendency to color in one case or another, they have only taken advantage of the tendency, which cannot thus be said to have resulted solely on their account and by their selection.

GLEANINGS.

To remove the old wood from the raspberries when the ground is frozen, a good way is to give a quick jerk, which will usually break them off at the top of the ground.

Scientific Tests in Hungary show that corn will produce the largest yield of milk, while sorghum will produce milk of the richest quality.

The Phylloxera. — Magnesia forms a very important constituent in all soils in which the French vine resists the phylloxera, and in those where the American vine flourishes best. Its percentage in the ash of the American vine is more considerable than in the ash of *V. vinifera*. Practical experiments are needed on the use of magnesium-ammonium phosphate as a manure for vines.

Floating Gardens. — The floating gardens of the rivers of Cashmere are formed by the long sedges being interwoven into a mat, earth being superimposed thereupon, and the stalks finally cut under water, thus releasing them from the bottom of the lake; they are usually about twenty by twelve yards in size. A dishonest Cashmere will sometimes tow his neighbor's garden away from its moorings, and appropriate its produce, which generally includes cucurbitaceous fruits and vegetables, and a fine description of grape.

Soot-Water. — The best way to make soot-water is to put a couple of bushels of soot into a stout canvas bag into which a piece of stone or iron has previously been thrown as a sinker; then tie up the bag tightly, and throw it into a tank of pure water. None of the crude carbon makes its escape; but by this method all the ammonia and other essential component parts of the soot which are really soluble are secured: and either for syringing or watering, it is of the highest value.

The Rabbit Pest. — The increase of rabbits in Australia has, in spite of measures heretofore tried for its reduction, become such as to threaten the extinction of farming industry. The government has offered a prize of a hundred and twenty-five thousand dollars for an effective method of destroying the pest. Pasteur is a candidate for this prize, and his method consists in the introduction of the virus of chicken cholera. Rabbits, he claims, are very susceptible to this poison; and he assumes that the establishment of the disease in one of their colonies would soon be followed by universal infection through the medium of the droppings.

Cheap Irrigation for the Family Garden. — An exchange commends a system of "cheap irrigation for the family garden," which has been tested for years with increasing satisfaction: "Take emptied fruit-cans, place the open end on a hot stove a short time to remove the top, punch about four small holes in the edge of the bottom, set them half their depth in the ground, and plant your seeds around them. Fill with water or liquid manure as often as need be. Cucumbers and the like will take a quart can full every day it does not rain. No baking of surface, no weed-seed, and speed in watering, are some of the advantages."

The Purslane Worm. — Farmers and gardeners frequently have occasion to rejoice in the increase of a certain class of insects, called parasites, that prey upon and destroy other insects which feed upon the vegetable kingdom; but they very rarely have reason to welcome vegetable-eating insects. According to Professor Snow of Kansas, however, that State and others adjoining are invaded by a caterpillar that feeds upon the purslane weed. There are few gardeners who have not had severe struggles to suppress purslane. During the past season the purslane worm has invaded Kansas in large numbers, exciting a good deal of fear in those who are in the habit of regarding all worms as enemies of the tillers of the soil.

A Great Place for Celery. — It is in and around the fair and far-famed city of Kalamazoo, says the *Chicago Herald*, that the celery lord, with all his innate pride and odor of garlic, may best be found. Here his coat-of-arms, consisting of a celery penchant on a silver dollar guardant, may be seen emblazoned on his armorial bearings, and also on the faces of the shopkeepers. Here it is that over three thousand acres of "reclaimed" land is devoted to the cultivation of the crisp and toothsome stalk that is gifted with nerve-strengthening properties. In spite of the fact that Kalamazoo leads the country in light vehicles, windmills, harrows, and many other branches of manufacture, she still pins her faith and hope and trust to the celery lands and the celery lords.

The Popular Science News.

BOSTON, MARCH. 1, 1888.

AUSTIN P. NICHOLS, S.B. . . . . *Editor*
WILLIAM J. ROLFE, LITT.D. . . . . *Associate Editor*

The editorial chair left vacant by the death of Dr. Nichols will not soon be filled by one possessing the same power of placing the dry facts of science in a clear and attractive form before the unscientific reader, or of showing the intimate connection between its fundamental principles and the affairs of every-day life. It is, however, only proper to state that the management of the *Popular Science News* will continue in the same hands as heretofore. During the last years of his life Dr. Nichols frequently contributed to its columns, but left the actual editorial management to his associates; and they feel confident, that, with the aid furnished by the numerous eminent scientists who have promised to contribute to its columns in the future as in the past, they can continue to conduct the paper in a manner worthy of its honored founder.

Professor Asa Gray of Harvard University died at his home in Cambridge on the 30th of January, at the age of 77, after an illness of several months. Professor Gray was widely known through his admirable series of school text-books, and was one of the foremost botanists in the world. He was the friend and correspondent of Darwin, and one of the strongest supporters of the evolutionary theory, although his views of its bearing upon theological matters differed widely from those of its originator. While Darwin was inclined to an agnostic belief, Professor Gray found no conflict between the doctrine of gradual development, and the existence of a Supreme Being. Darwin, in his letters recently published, refers to Gray as one of the three or four whose judgment on his theory was of more value to him than that of the world besides, including him with Hooker, Lyell, and Huxley. From a personal acquaintance with Professor Gray we can bear witness to his invariable kindness and courtesy towards all who had the pleasure of knowing him, and he will be missed even more as the instructor and friend than as the man of science whose labors accomplished so much for its advancement.

Scientists have long sought for a fixed and invariable standard of length. The measures in common use are mere arbitrary lengths, and, if the original standards should be destroyed, could not be accurately replaced. The French meter is supposed to be a ten-millionth part of the quadrant of the earth; but the accuracy of the original measurements has been seriously called in question. The so-called wave-lengths of light have been suggested as furnishing an invariable numerical magnitude; but their excessive minuteness, and the difficulty of accurately measuring them, have heretofore been an insuperable objection to their use. Messrs. Michelson and Morley have now devised a method of measuring these wave-lengths, which they claim is probably accurate to one ten-millionth part. When it is considered that a wave-length of sodium (yellow) light is only about one forty thousandth of an inch, the delicacy of this method becomes apparent. Whatever theory may be held as to the nature of light, the numerical values called for convenience "wave-lengths" are actual and invariable magnitudes of *something;* and if the new method of measurement proves reliable, there will be no difficulty in obtaining a fixed standard of length which can be reproduced at any time or place.

From certain observations upon the solar spectrum, Mr. H. Crew finds that the period of rotation of the equatorial region of the sun is 25.88 days, corresponding to a velocity of .024 mile a second.

The recent total eclipse of the moon was a spectacle of rare beauty, and occurred under exceptionally favorable conditions. At Boston the moon was about half obscured on rising; and the gradual extension of the earth's shadow over the disk, and its reappearance in its accustomed brightness, were observed in a sky entirely free from clouds, and through the clear, pure atmosphere of a winter evening. Advantage was taken of the eclipse by astronomers to determine the time of the occultation of certain small stars by the moon, which would have been invisible in the ordinary brightness of its light; but, aside from this, the eclipse was of little actual scientific importance.

Some German chemists are said to have produced artificially in the laboratory a substance closely allied chemically to glucose, or grape-sugar, and possessing many of its well-known physical qualities of sweetness, etc. While from a scientific point of view the synthesis of such a complex compound is of the highest importance, it is practically of no consequence whatever, as the cost of a sugar formed by any such process must necessarily be far above that of the product made in the well-known way, by the action of acid upon starch.

A paper by Professor Gruenwald, recently published in the *Chemical News*, upon the spectra of hydrogen, oxygen, and aqueous vapor, is an extremely important one, and, if his theory is fully confirmed, may revolutionize our ideas of the constitution of matter. It would be impossible to do full justice to the paper without entirely reprinting it; but it may be briefly said that Gruenwald claims to have discovered, from the spectra of these gases and vapors, that hydrogen is a compound of one volume of a primary substance, *b*, with four volumes of another primary substance, *a*, and is therefore a compound substance, analogous to ammonium (NH_4), the volume of which, on its dissociation at a sufficiently elevated temperature, is in the proportion of 2 to 3. The substance *a* is the lightest of all gaseous bodies, — much lighter than hydrogen; and *b*, if we regard *a* as a univalent element, is a pentavalent gaseous element similar to nitrogen. He has also found oxygen, carbon, and nitrogen to be compounds of simpler substances. The element *b*, noted above, corresponds with the assumed element occurring in the sun, and known as "helium;" thus proving that hydrogen is disassociated in the sun's atmosphere. Another unknown substance present in the sun's corona which gives the spectral line 1474, he concludes, is due to the other constituent of hydrogen, *a*. Much more extended observations will be necessary to prove the correctness of this alleged discovery; but the facts brought forward by the author are sufficiently confirmatory to justify the most thorough investigation of the matter.

Some time ago a reader of the *News* wrote to the "Questions and Answers" column desiring to know the difference between a thermometer and a barometer. As similar inquiries are not uncommon, the lack of scientific knowledge thus displayed was not especially noticed by us. It happened, however, that at a meeting in this city of a literary club, consisting of over a dozen members, the same question was recently brought up, and not a single person could answer it. All the members were highly educated, in both public and private schools and academies, and yet not one of them had had sufficient elementary instruction in science to enable him to understand the construction of these two simple and familiar instruments. It would certainly seem as if the courses of study in our educational institutions were in need of revision.

The efficiency and value of our schools do not seem to increase with the introduction of the complicated and expensive "modern methods of instruction." We have an unlimited number of superintendents and supervisors, innumerable written and oral examinations and reviews, a "seven account" arrangement of "marking" for recitations, and a curriculum which embraces every branch of knowledge of which the human mind has ever conceived; and yet on graduation, the amount of actual knowledge possessed by the pupils is phenomenally small. Our public-school system is fast approximating to the same condition as that of the government of the Sandwich Islands, which a witty writer describes as "the works of the Great Eastern in a sardine box." We have a most complete and thorough "system," but it is fast overshadowing the schools themselves.

PREHISTORIC MONUMENTS IN THE PYRENEES.

In a recent number of *La Nature* M. Julien Sacaze gives a very interesting account of some prehistoric monuments on the Mount d'Espiaux in the French Pyrenees, recently

visited by him. Such monuments are very numerous on this mountain, and occur at a height of about four thousand feet.

These monuments consist of rough blocks

FIG. 1.

of stone, mostly erratic bowlders, which have been arranged either in long lines or in groups of circles. One of the linear monuments is eight hundred and fifty feet long, and is composed of ninety-three stones, the largest of which measures over fifteen hundred cubic feet. A plan of a group of circles is shown in Fig. 1 which contains one hundred and sixty-three stones. Whatever may have been the object of the long lines of stones, there is no doubt that the circular structures were sepulchral monuments. In the centre of each circle is a rectangular cavity from one to three feet deep, and about eighteen inches square, lined with slabs of stone or small pebbles, which usually contains fragments of charcoal and calcined bones. Cinerary urns have also been found which have been referred to the time of the bronze age. M. Sacaze also discovered two bronze bracelets which were identical in form and ornamentation with ones found in the Swiss lake-dwellings, and unquestionably belong to the same period of time.

FIG. 2.

Another most interesting discovery on this mountain was the so-called "basin-stones,"—large blocks of granite in which numerous hollow depressions have been carved by the hand of man. They sometimes occur by themselves, and sometimes in a line or circle of unmarked stones. One of the finest examples of these is illustrated in Figs. 2 and 3; the latter engraving giving an enlarged view of the depressions — or *cupules*, as they are termed. This stone (the upper one in the engraving) is popularly known as the *Calhau des Pourics*, or the "chicken-stone," and has ninety-eight cupules upon its surface which measure about an inch and a half in diameter, and three-quarters of an inch in depth. The resemblance of these stones to those recently found on the Isthmus of Panama, and described in the January number of this paper, is a very remarkable and interesting coincidence. Certain other blocks have been found in which the depressions are longer and deeper, and are called by the peasants "the print of the giants' fingers."

The significance or use of these stones is unknown, but they probably were connected with the religious or superstitious practices of the prehistoric people. Even at the present day certain of these stones are supposed by the native peasants to have magical powers, and in 1871 their vulgar practices were carried so far as to cause the parish priest to cut a cross upon a rock known as the *Arriba-Pardin*, in a vain attempt to suppress them. Whether these beliefs are a direct survival of the primitive ceremonies, or have originated in later times, is unknown; and unless unexpected discoveries should be made, it is not likely that we shall ever know much more about those wonderful peoples, whose stone circles and monuments have been found in all the parts of the world.

[Special correspondence of the *Popular Science News*.]

BERLIN LETTER.

THE Crown Prince's illness is still the absorbing topic here. Though we now trust it is not cancer, yet Dr. Schenerlen's study of the cancer bacillus, the existence of which has been much doubted, has produced results none the less important to science. The bacteria collection of the Berlin firm of Klöune & Müller is enriched with a stock of these bacilli, prepared for the microscope. They find a ready sale both among Germans and foreigners. One preparation in double coloring shows the spores distinctly, and is furnished for three marks; the one-colored preparation is sold for two marks. The first supply was soon exhausted, and a second edition called for.

WHILE I am on the subject of disease-germs, I will mention a rather singular case of lock-jaw recently reported from Greifswalde. A young man was playing at ten-pins, when, in projecting the ball, he thrust a splinter under the nail of his middle finger to the depth of three-quarters of an inch. In seven days he was attacked with slight pains in neck and back, and one day later with cramp in breast and abdomen. The lower limbs and the whole length of the spinal column were soon similarly affected. An incision was made in the injured finger, and a portion of the splinter, still remaining under the nail, was removed. Yet, on the third day after the first attack of cramp, death followed. Dr. Beumer of Greifswalde now proceeded to examine more closely the cause of this fatal attack. A piece of wood was taken from the floor of the bowling-alley at the players' end, and also some earth from the lower end. A number of rabbits and white mice were then inoculated, some with one of these substances, others with the other; and in every instance the same phenomena followed as in the case of the young man, proving to Dr. Beumer the presence of the bacilli, or germs of lock-jaw, in the wood of the alley and in the soil beneath.

THE scheme for improving the Lower Weser up as far as Bremen, in order to admit the larger vessels which now have to stop at Bremer Haven at the mouth of the river, is at length to be carried out; and a tonnage of one mark on all such vessels will then be imposed, to help reimburse the outlay of thirty millions which the enterprise demands. Only after long negotiations between Oldenburg on the one side of the river, Prussia on the other,

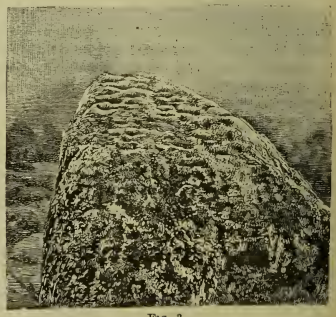


FIG. 3.

and the municipality of Bremen, was this improvement, which will vastly benefit the whole empire, finally decided upon. The technical difficulties in the way of the great enterprise, and, still more,

doubts as to its economical success after completion, retarded the acceptance of the plan. Yet the benefit accruing to Bremen alone, and the maritime population on both sides of the river, leaves little question as to the financial expediency of the work.

The annual report of the imperial patent-office, recently published, presents some interesting facts. To American readers, with our annual grant of some 20,000 patents, they are matter of some surprise. Only 3,882 patents were granted out of 9,904 applications. This is a marked falling-off from the previous year, when 4,008 patents were granted out of 9,991 applications. Far more than half of the applications are yearly rejected, and this, too, in most cases because the inventions are found to be already in existence. Statistics show that most inventors here are unfortunate with the products of their ingenuity. Up to the present time 42,451 patents have been granted, while only 11,512 of the inventions are in the market; failure to pay the patent-dues accounts for the rest. The greater number of the invented articles in the report come under the head of electric appliances, tools, and household utensils. Saxony with 451 patents, and Berlin with 442, show the greatest inventive genius; Bavaria and Alsace-Lorraine the least. Of the whole number of grants, 2,561 were to German subjects, 1,321 to foreigners; the latter number being very small in view of the 15,000 annual grants in England, and 20,000 in the United States. The receipts of the department increase yearly, while the expenses remain the same. A surplus of nearly one million marks is reported.

Readers of German will be glad to learn the progress of the society for the abolition of those twenty-six deformities through which German thought is commonly represented to the eye. At present the school-children have to learn eight alphabets, counting the capital and small letters of both Latin and German form in print and running hand. The society was formed in 1884; in 1886 it numbered 2,871 members, and in 1887 4,436. The greater part of the members are teachers in the primary and grammar schools, though many names of *gymnasium* and *real-schul* teachers are on the list, while in the last year thirty-one university professors joined in the ranks. Physicians, book-dealers, and business-men are also represented. It is said that the old alphabet would have been officially done away with before this but for the obstinacy of the chancellor: Bismarck will read no letter which comes to him in Latin script. It is to be hoped that Germany will not much longer make herself an exception to the rest of Western Europe by this absurd reverence for the invention of a few idle monks in the Middle Ages.

I see in my morning paper the notice of a book just published by Dr. Theodore Heryng, formerly of Warsaw, and now living in San Remo. He is one of the most noted laryngologists, and his book handles exhaustively the *Heilbarkeit der Kehlkopfschwindsucht* (the curability of laryngeal consumption). Until recently this was held to be incurable. In 1880 Dr. Moritz Schmidt of Frankfort, who has since become so well known, advanced contrary views based on an extended practice, opening the way to a rational treatment of the disease by chirurgical operations. He was followed in 1885 by Dr. Hermann Krause of Berlin, who first aimed at a cure by the use of lactic acid. This field has now been further developed by Dr. Heryng, whose observations and experience in a great number of cases are given to the public. The principles of treatment are, in brief, as follows: Prompt destruction and removal of the affected tissues; transformation of vicious ulceration into less harmful ulcers, and intelligent cure of the same. Ulcerous appearances are to be artificially irritated, and thus their cure hastened; means for removing the accompanying inflammation and difficulty in swallowing are given. An equally important part of the treatment is the general strengthening of the system, and a due consideration of climatic and hygienic influences. The work contains several illustrations, treats especially the *Pachydermia diffusa* as described by Virchow, and explains minutely the treatment with lactic acid, the treatment by incision, and the application of iodine. Specialists regard the book as of great value. It is published by Ferdinand Euke in Stuttgart.

P. F. Bicknell.

Berlin, *Jan.* 21, 1888.

[Specially reported for the *Popular Science News* from the Observatory of the College of New Jersey.]

ASTRONOMICAL PHENOMENA FOR MARCH, 1888.

The Sun crosses the equator and spring begins on March 19, at 11 P.M. Mercury passes inferior conjunction on March 3, and becomes a morning star, reaching greatest west elongation on March 30, when it is a little less than 28° from the Sun; but, as it is at the same time about 12° south, it will be only about 10° high at sunrise. It may possibly be seen on a very clear morning a little before sunrise on the last few days of the month. Venus is still a morning star, but rapidly approaching the Sun. Venus and Mercury have a very close conjunction on March 27. The nearest approach occurs at 8 P.M., when the planets are only 2′ apart; but they are then below our horizon. On the morning of the 27th they are 15′ apart, Mercury being on the left; and on the morning of the 28th they are about 6′ apart, Venus being on the left. If the weather is fine they may possibly be seen just before sunrise. Mars is getting near to opposition with the Sun. At the end of the month it is on the meridian about 1 A.M. It begins its retrograde motion among the stars on March 3, and moves toward the west toward Spica, being at the end of the month about 7° east and north of that star. Jupiter is in Scorpio, nearly stationary, about 6° north of the brightest star of the constellation Antares, and 4° east of the second-magnitude star *Beta* Scorpii. It is on the meridian at about 5*h*. 30*m*. A.M. on March 1, and at about 3*h*. 30*m*. A.M. on March 31. It then rises at about 11 P.M. Saturn is still in Cancer, about 10° west of Castor and Pollux. It crosses the meridian at about 9*h*. 20*m*. P.M. on March 1, and at about 7*h*. 30*m*. on March 31. Uranus is approaching opposition, and is in Virgo, about 7° north and west of Spica. Neptune is about 5° south of the Pleiades.

The Constellations. — The positions given are for the latitude of the northern part of the United States, and for 10 P.M. on March 1, 9 P.M. on March 16, and 8 P.M. on March 31. Cancer, with Saturn near its western part, is not far from the zenith, a little to the south. Leo lies east of Cancer, and Virgo lies below Leo, reaching to the horizon on the east. Between these constellations and the southern meridian are Hydra and one or two small constellations. On the north-east are Ursa Major well up toward the zenith, and Boötes and Corona low down. Draco and Ursa Minor lie mainly to the east of the pole star, while Cepheus is just below it. Andromeda is just setting in the north-west, and Cassiopeia lies between it and the pole star. Perseus is above Andromeda, and Auriga above and to the south of Perseus. Gemini is west of the zenith, high up; and Taurus is low down in the west, just above Aries, which is setting. Orion is to the left of Taurus a little lower down. Canis Minor is about halfway from zenith to south-west horizon, and Canis Major is below, between Orion and the southern horizon.

M.

Princeton, *Feb.* 3, 1888.

[Specially reported for the *Popular Science News.*]

METEOROLOGY FOR JANUARY, 1888.

TEMPERATURE.

Average Thermometer.		Lowest.	Highest.	Range.
At 7 A.M.	13.84°	−8°	41°	49°
At 2 P.M.	22.42°	2°	36°	34°
At 9 P.M.	17.38°	−4°	51°	55°
Whole month	17.88°	−8°	51°	59°
Last eighteen Januarys	23.53°	17.50°, in 1875.	32.98°, in 1880.	15.48°

The 28th was the coldest day, with an average of 2½° below zero; the 1st was the warmest, at 38° above. The lowest point reached was −8°, on the mornings of the 25th and 29th; the highest point was 51°, on the evening of the first day. The mercury went below zero ten times in nine days between the 21st and 29th, amounting to 43°. These nine days averaged only 7.04°, or, omitting the 26th, a sudden warm day near the midst of the nine, the remaining eight days averaged only 4.29°, — the longest, coldest period of severe weather in this locality during at least the last eighteen years. The first fifteen days of the month averaged 25.38°, the last sixteen only 10.85°. The entire month was 5.65° below the average in the last eighteen Januarys, and was the coldest, with one exception (1875), during this period. In that year the mercury went below zero but six times, the lowest only 5°, — a very cold month, indeed, but of much more even temperature than the present, in which the first half of the month was nearly 15° warmer than the last half. The 26th was remarkable for the sudden changes, the mercury going up 46° in twenty-four hours, and then returning 35° in the next twenty-four. Though we have had no blizzards in this locality, the severity is somewhat in sympathy with what has been experienced in various parts of the country.

SKY.

The face of the sky in 93 observations gave 57 fair, 6 cloudy, 17 overcast, 4 rainy, and 9 snowy, — a percentage of 61.3 fair. The average fair the last eighteen Januarys has been 53.9, with extremes of 40.9, in 1884, and 61.3, in 1878 and 1888; showing that no January in eighteen years has exceeded the present in this respect, and only one other has equalled it, — clear, but cold. We had several fine sunsets, and also sun-risings, adorned with unusually brilliant morning stars, Jupiter and Venus being near each other in the early part of the month, and accompanied one morning by the near proximity of the bright crescent moon, — a beautiful sight. We had several fine days during the month, especially the last day, fine, clear, and calm, and not severely cold.

PRECIPITATION.

The amount of precipitation the past month, including 14 inches of snow melted, was 6.31 inches. The average for the last twenty Januarys has been 4.72, with extremes of 1.80, in 1871, and 7.76, in 1885. The largest fall the present month, principally of rain, was 3.27 inches, on the 1st. A light snow on the 10th, increased by 4 inches on the 13th, with severe cold, secured excellent sleighing for the rest of the month.

PRESSURE.

The average pressure the past month was 30.026 inches, with extremes of 29.12, on the 26th, and 30.66, on the 12th, — a range of 1.54 inches. The average pressure in January the last fifteen years has been 29.973, with extremes of 29.840, in 1879, and 30.080, in 1880. The sum of the daily variations the last month was 9.73 inches, giving an average daily movement of .314 inch. This average in fifteen Januarys has been .297, with extremes of .196 and .391. The largest daily movement was .95, on the 26th, .91 being the fall in ten hours, in connection with that sudden change of temperature and a large precipitation. Only two Januarys in fifteen years have had a higher pressure than the present.

WINDS.

The direction of the wind in 93 observations gave 16 N., 1 S., 2 E., 15 W., 4 N.E., 47 N.W., 1 S.E., and 7 S.W., — an excess of 58 northerly and 62 westerly over the southerly and easterly, and indicating the average direction to have been W 43° 5′ N. Full one-half the winds of the month have been north-west. The westerly winds in the last nineteen Januarys have uniformly prevailed over the easterly by an average of 53.58 observations, and the northerly over the southerly, with two exceptions, by an average of 21.37; indicating the approximate general average direction in January to have been W. 21° 45′ N. The relative progressive distance travelled by the wind the past month was 84.89 units, and during the last nineteen Januarys 1,096 such units, — an average of only 57.68; showing far less opposing winds the last month than usual. But the month will be chiefly memorable for the severity of its protracted cold, and consequent frightful suffering and loss of life in various parts of the country.

D. W.

NATICK, *Feb.* 4, 1888.

Correspondence.

Brief communications upon subjects of scientific interest will be welcomed from any quarter. The editors do not necessarily indorse all views and statements presented by their correspondents.

DO HORSES HAVE HORSE SENSE?

EDITORS POPULAR SCIENCE NEWS:

IN a recent number of the *Science News* is reprinted a short extract from the Chicago *Journal* by a writer who asks, "Have horses horse-sense?" He tries to maintain that they have not by asserting that he has seen horses that would wind themselves up to a post by walking round and round until the halter was so short that they could no longer move their heads. He brings forward several similar instances, all true, to prove his point. But the argument is inconclusive, as the writer should have seen. There are horse-fools, as there are man-fools; and one would scarcely like to have the writer of this paragraph quoted as an illustration of the highest wisdom of the human family. He is probably better acquainted with the story of his life than any one else, and perhaps recollection will bring to his mind times when he has not done the wisest thing himself. Or, failing this, he may find plenty of examples of folly in man without going very far. I knew a servant who was directed to make some pillow-cases, and who, finding that the pattern had been torn, tore all the new ones, and sewed them up again, to match the pattern. This was as good as the story of the Chinese who cracked every piece of a costly set of ware, because the pattern was so cracked, and then charged an enormous price on account of the difficulty of "making the crack." Not to go into details, are not many of the absurdities of modern dress and other fashions as inconvenient and senseless as the tightness of a wound-up halter? Are the human fools that are so easily taken in by the confidence-man and the card sharper very much ahead of the horse that is startled because his foot is entangled in the bridle? It does not take so very much to startle some members of the human family; and when they are startled, they will do the most outrageous and senseless things. Who has not seen and heard of such acts in the alarm of a fire? Fragile articles are then thrown out of the window, and beds are carried carefully down stairs. The question is not, "Have all horses at all times and in all circumstances good horse-sense?" but, "Have any horses at any times and in any circumstances this sense?"

I will match the horse mentioned in the extract from the Chicago *Journal* by one with which I was acquainted, whose owner was unable to confine him to his stall by any ordinary means. He learned to lift the latch of the door, and let himself out, and would then open the other doors, and let out the other horses, apparently for his amusement. The owner then bored a hole in the door at the back of the latch, and put in a wooden pin. This answered for a few days, but then the colt taught himself to pull out the pin; and he invariably carried it off, so that it was never found again. A friend of mine has an old horse that will do the same, and can open any stable door that is not locked. Yet more: I was once acquainted with a donkey that taught himself to unlock a door, and let himself into a garden. This he did by putting his tongue through the bow of the key, and then turning it. It was a puzzle how he got into the garden until the gardener watched and saw him do it.

It is no more fair to brand all horses as fools, on account of the folly of some, than it would be to adopt Carlyle's opinion of the human race in England, because he had unfortunately met with some not remarkable for wisdom. "There are in the United Kingdom about thirty millions of people, mostly fools."

E. W. C.

THE RECENT WESTERN BLIZZARD.

EDITORS POPULAR SCIENCE NEWS:

DURING the commencement of the great blizzard that swept over the north-west on the 12th of January, the strong wind was blowing snow directly from the east, sifting it fine as flour into every chink and keyhole it could find. About one o'clock P.M. there was a partial lull, so that we could see the silvery rills skipping over the drifts, and a dark shadow fell upon the landscape, plainly visible, and engaging the attention; and, in less time than I can describe it, the wind reversed its compass, charging in upon us from the west; and such a blinding storm, and clash and fury of the elements! It was, indeed, a sublime terror, chaining every sense to look upon and hear, with a pitiful feeling going out to forlorn travellers so suddenly overtaken on the treeless prairie. That night special pains were taken to have our room comfortably warmed by extra fire. Our whole persons were electrically charged, the hair of our heads "standing on end," as in states of insulation. Flashes could be seen playing around the picture-frames, and electric shocks were felt when touching the cords attached to them. While in bed, the clothes, with an extra comforter, were so tucked in, it was impossible for any wind to creep under them; yet the concussion of the storm against the wall of the house and the glass of the double windows was sensibly felt, trembling the nerves, and causing cold shivering. I have had such experiences before during colliding winds and snows, but never in so marked a degree.

J. O. BARRETT.

BROWN'S VALLEY, MINN., *Jan.* 30, 1888.

LITERARY NOTES.

A Text-Book of Inorganic Chemistry. By Professor Victor von Richter. Translated by E. F. Smith, PhD. P. Blakiston, Son, & Co., Philadelphia, publishers. Price $2.00.

This is the third American translated from the fifth German edition of Richter's admirable text-book on chemistry. Its system of instruction is such that the theories and facts of chemical science are taught at the same time, to the great advantage and convenience of the student. Unusual attention is given to the recently discovered "periodic law" of the elements, and this very important subject is fully and clearly explained. This chemistry is used in many schools and colleges, including Yale and Dartmouth, and is to be recommended as a most excellent work.

This firm has also just issued the sixth edition of *Blozam's Chemistry*, both inorganic and organic, complete in one volume, price $4.50. This work is now universally recognized as a standard, and we need only say that this edition has been thoroughly revised, and a large part rewritten, by its distinguished author, and was completed just before his death, which occurred last November.

The same firm publish the *Chemical Analysis of Urine*, by T. C. Van Nüys. Price $2.00. Both quantitative and qualitative methods are described, and the subject is very exhaustively treated according to the latest discoveries in this important branch of medical chemistry.

Astronomy for Amateurs. Edited by John A. Westwood. Oliver, Longmans, Green, & Co., New York, publishers. Price $2.25.

This work is intended for the use of such persons as have a desire for original astronomical investigation, but whose instrumental means are limited. It contains numerous hints and suggestions which amateur observers will find of great value; and it will be especially useful in teaching them how to make the best use of such apparatus as they may possess. The editor in compiling this book has had the co-operation of some of the most eminent astronomers in England.

This firm will also publish early in the present year a new work on astronomy by Richard A. Proctor. It will be issued in twelve monthly parts and a supplement. It will treat, in a popular style, of all the latest discoveries in this fascinating science, and will be beautifully illustrated. Full particulars will be announced later.

The Management of Accumulators, by Sir David Salomons, will be of interest to all professional or amateur electricians, from its very full and complete directions for the care and management of this type of battery which is now coming into such extensive use. D. Van Nostrand, publisher, New York.

The Evolution of Immortality, by C. T. Stockwell, is a well-written little treatise on the immortality of man, based upon scientific and philosophical considerations, which is worth reading by those interested in the subject. Price $1.00. C. H. Kerr & Co., Chicago, publishers.

The Puzzler is a new monthly magazine of puzzles and game-problems, published by N. D. C. Hodges, 47 Lafayette Place, New York, at $1.20 per year. The first number is at hand, and promises to fill a place heretofore unoccupied in the journalistic field.

Pamphlets, etc., received: *The Movements of the Earth*, by J. Norman Lockyer, Macmillan & Co., New York; *English in the Schools* and *English in the Preparatory Schools*, D. C. Heath & Co., Boston; *The Galvano-Cautery Sound in Diseases of the Prostate*, by Robert Newman, M.D., New York; *Should Physicians be Pharmacists?* by Charles L. Mitchell, M.D; *The Dentists' Manual of Special Chemistry* ($2.25), by Clifford Mitchell, M.D., 603 Rialto Building, Chicago; *Annual Announcement and Report of the Cooper Medical College and Morse Dispensary*, San Francisco; *Report of the Illinois State Board of Health, Agricultural Reports of New Jersey and Georgia*, and the *Quarterly Report of the U.S. Bureau of Statistics.*

Medicine and Pharmacy.

THE HEALING ART.

It is a common remark that physicians are mere experimentalists, and that medical practice is purely empirical. It is easy to cite cases in which the doctor has evidently been working in the dark, and the autopsy proves that, in feeling his way, he has got far off from the proper course. When we consider what a complicated organism the human body is, and how almost infinitely varied are the causes which may disturb its normal action, and that these causes may act, not only singly, but in countless combinations, each modifying the outward manifestation of the disturbance, we cannot wonder that occasionally the diagnosis of disease is a peculiarly obscure and perplexing problem. It is nevertheless true that medicine is daily becoming more and more an exact science. When we review what has been done in the past fifty years for the alleviation of disease, we can see a long series of medical triumphs. We limit the retrospect to the half-century, because so many of the greatest discoveries in medicine and surgery have been made within that period, and a large proportion of these within the memory of comparatively young practitioners. Macaulay has somewhere said that the poorest man of our day has the advantage of medical skill such as monarchs could not command a century or two ago; and if we should cut down the time mentioned to the limit suggested above, the statement would still be strikingly true. Fifty years ago there was no anæsthetics to produce insensibility to pain, no antiseptics to promote the healing of a wound, no chloral to produce sleep, no anti-pyretic in general use to control fever.

The first of these great improvements — the use of anæsthetics in surgery — is perhaps the most important since the introduction of vaccination in 1799; and it may be a question whether it has not relieved a larger amount of human misery than even Jenner's famous discovery. It has rendered possible many surgical operations that were before wholly impracticable; and the antiseptic treatment, for which surgery is indebted to Lister, has added immensely to the number.

The healing art is largely empirical still; for, though the symptoms of disease and the remedies to be applied are far better understood than formerly, much yet remains to be learned, both in pathology and therapeutics; and the next half-century may be expected to show a greater progress in these and all other departments of medicine than the past fifty years. Chemical science is continually adding fresh and potent agents to the armory of the physician, to say nothing of the fact that he is constantly gaining knowledge of the enemy against which he fights. He is becoming better and better acquainted with the vulnerable points of his adversary, while the weapons he can wield in the battle are more numerous and more efficient. Besides, so much more is now known than formerly concerning the laws of health and disease, that the modern doctor, if he is unable to cure, has at least sense enough not to kill.

"Preventive medicine," which is but another name for sanitary science, has been wonderfully developed in these latter years. Medical men are learning that more can be done for the general health by removing the causes of disease than by efforts to cure it after it is once in existence. In the case of contagious diseases there has been a marked advance in the methods of arresting their diffusion.

With the increase of his knowledge, the modern physician has, moreover, become the more conscious of his ignorance, and consequently is disposed, as far as he can, to wait on nature, trusting to her help, and removing obstacles from her path. The history of the healing art shows that this principle was not so much recognized in former days. Then the doctor, instead of trusting to nature, in cases where he really did not know what to do, was inclined to try drug after drug, in the hope of hitting upon the right one, very much as people who "doctor themselves" nowadays experiment with one patent medicine after another. In the olden time the medical man rarely failed to write a prescription when he was called in, and the dose was apt to be "heroic" withal: now he gives advice oftener than medicine; and if the patient, as sometimes happens, is not satisfied without the latter, a mere *placebo* is administered, and the "mind-cure" left to do the rest.

The real advance that has been made in the healing art in recent times is shown by vital statistics. These prove that medical and sanitary science have diminished the death-rate to such an extent as to add two years to the mean duration of life in Great Britain; and the average result has probably been about the same in our own and other enlightened countries. This is in itself a great gain, and it is one that we may reasonably expect will steadily increase. It would be interesting to know what share of it is thus far due to medical and what to sanitary progress, but it is impossible to determine this from the statistics. The diminished mortality that has resulted from hygienic precautions can, of course, be demonstrated in many instances; but to trace out their entire effect in this direction is at present beyond our ability.

[Specially compiled for the *Popular Science News.*]

MONTHLY SUMMARY OF MEDICAL PROGRESS.

BY W. S. WELLS, M.D.

A case of *hydatids in bone* is reported, in a recent issue of the *Australasian Medical Gazette*, by Dr. C. G. Leacock, M.R.C.S.E. This somewhat rare disease of bone occurred in a man, aged forty, who had been troubled, off and on, with his left knee since he was twelve years old, when he received a blow from a cricket-ball. This disabled the limb for some time, but he ultimately recovered the full use of the joint. Some years later he was kicked by a horse on the same knee; and from this he never fully recovered, the joint being always weak, swollen, and at times painful. Subsequent sprains of the joint occurred, and other injuries, keeping the unfortunate joint in a chronic condition of irritation. About four months ago the patient came under the care of Dr. Leacock, through having struck the knee violently against a post, inducing acute synovitis. Treatment seeming of no avail, and the health of the patient beginning to break down from constant pain, referred particularly to a spot on the inner condyle of the femur, an operation was suggested, — resection, or amputation if found necessary. On opening the joint, there were the usual evidences of chronic inflammation, but no pus. On digital examination, a perforation was found, admitting the tip of the finger, between the condyles of the femur. On applying the saw to the condyles of the femur, there was scarcely any resistance; the bone, in fact, was a mere shell, in some parts scarcely thicker than paper. Amputation was performed, as the only resource, at the lower third of the thigh. On examining the removed limb, the lower end of the femur was found hollowed out into one large cavity, stuffed full of hydatid cysts, from the size of a small pea to nearly an inch in diameter. The cancellous structure in the head of the tibia was undergoing fatty degeneration, and in the popliteal space was an ounce or more of broken-down soft tissue. The stump healed almost entirely by first intention.

The diseased joint had been subjected to a series of injuries during a period of twenty-eight years, but there were no means of knowing how long the changes in the femur had been going on. Dr. Leacock is of the opinion that a correct diagnosis could have been arrived at only by trephining the bone at the seat of pain.

In his day, the celebrated French surgeon Nélaton made some experiments to show that in chloroform narcosis the respiratory and cardiac centres are weakened by an anæmic condition of the brain. The exposed brains of animals experimented upon were noticed to bleach as chloroform vapor was inhaled by them to complete anæsthesia.

When this whitened appearance indicated insufficient blood-stimulus to the great nerve-centres, their functions ceased, first in volition, next in voluntary movement, then in general sensation, and finally in the arrest of involuntary or organic movements, including the action of the heart and lungs, and then death promptly ensued.

Nélaton found that, when a number of rats had become thoroughly narcotized with chloroform, those which he would immediately hang up by the tail would slowly revive, while those which were left supine on the table died.

If, when animation commenced to show itself in the hung-up rat, the animal was lain down too soon, breathing would again cease, and the rat would die unless immediately suspended, whereupon the respiratory and cardiac actions (the breathing and beating of the heart) would be resumed.

It was only after a sufficiently long suspension — giving the brain and heart ample time to have supplied them, by gravity, the requisite amount of blood — that death could be prevented. If the animal was not already dead, suspension, head downward, alone would restore animation.

The suspending of the human body, feet upward, to restore animation in chloroform narcosis or poisoning, was Nélaton's great discovery; and it is known as his method of restoring persons to life when, under the influence of chloroform or other anæsthetic, respiration has suddenly ceased. The knowledge of and faith in this method has served Dr. Julian J. Chisolm of Baltimore, Md., remark-

ably well on many trying occasions; and to this he accredits his clean record of over ten thousand cases of general anæsthesia and no death.

Dr. Chisolm, in a paper read before the Baltimore Academy of Medicine, details some desperate cases of apparent death suddenly supervening upon the administering of chloroform for surgical operations, which were resuscitated by prompt suspension by the feet long enough to allow the blood to gravitate sufficiently to the brain.

In his concluding remarks Dr. Chisolm advises never to administer an anæsthetic without there being present sufficient help to quickly handle the patient. Should there be any sudden and alarming weakening of the heart's action, — and of respiration, for they always go together, — without a minute's delay hang up the patient. Should the patient be bulky, and should there not be force present to elevate the foot of the bed or table, be the patient male or female, quickly stoop, throw his or her legs over your shoulders, hang on to the feet in front of you, and then lift yourself. The patient's body, as you get upon your own feet, will hang from your back, with the head down. Now you have time to call for help; but never wait for the help to come before you practise suspension, because with the moment's delay your patient may have passed from dying into death.

Should the alarm have been a needless fright, with only weakening, and not suspension, of the vital functions, no harm has been done. The feeble pulse will always respond promptly to suspension; and this suspension is preferable to hypodermics of whiskey or ether, or the inhalations of nitrite of amyl. Should vomiting occur, the suspended position is better for the patient than while lying upon the table, because there is less liability of food-particles getting into the larynx. Inversion of the body gives the contents of the stomach free vent. Dr. Chisolm has so much confidence in the value of suspension with chloroformed subjects, that he is disposed to believe that the vital centres cannot fail with the body hanging head down, and has often operated with the body in this position when there was tendency of failure of the heart, even lying supinely.

Dr. Walker Downie reports, in the *London Practitioner*, a number of observations on pharyngitis from excessive tea-drinking. This pharyngitis produces intense dryness of the throat, and is found in women badly nourished and anæmic, and who are in the habit of swallowing strong decoctions of tea with about every morsel of food of which they partake, as well as indulging between meals. In such cases he looks upon this form of dry pharyngitis as due to, not only the local effect on the pharynx itself of this frequently applied astringent and irritant lotion of stewed tea, but to a gastric derangement induced by the same.

He prescribes a chalybeate tonic, with a liberal diet of farinaceous food, with milk, and the total avoidance of the tea, just as we forbid the use of tobacco in inflammations of the mouth and fauces.

Dr. Thomas Barr, surgeon to the Glasgow Ear Hospital, reports, among other traumatic affections of the ear, a case of injury to the auricle, or external portion of the ear, exciting mastoid periostitis. The patient was a boy, who stated that three weeks previously a man caught hold of his ears, lifted him off the ground, and suspended him in this way for a few seconds.

The boy alleged that there was no pain at the time. A few days afterward, however, pain and swelling commenced around the auricle, which was treated by hot fomentations. On admission he was suffering from intense pain over the right mastoid region and side of the head. The pain was so severe, that he had not slept for two nights. The auricle was jutting from the side of the head, and the swelling and œdema extended from the mastoid region very markedly over temple, right side of forehead, lower eyelid, and front of ear. The swelling over forehead pitted deeply under pressure with the tips of the fingers. There was, however, very little redness anywhere. The internal ear was normal. There had been no rigors, but the temperature was 101°. Although there was no evidence of the existence of pus, it was resolved to cut into the tissues forming the seat of greatest pain.

Chloroform was used, and an incision two inches in length was made through the soft tissues and periosteum, to the bone. Only a drop or two of pus escaped, apparently from beneath the periosteum. The effects of this incision were most satisfactory. All the unpleasant symptoms rapidly abated, and in the course of a fortnight the boy was at work again, and the incision wound almost healed.

During the epidemic of small-pox last summer at Warsaw, Russia, the assistant physician in the University Clinic convinced himself that calomel applied as powder on the face when vesicles or pustules were developed, caused them to dry up, and prevented the formation of marks or pitting.

The calomel did not prevent the development of vesicles from the papules, and was only effective after maturation. Either calomel pure, or mixed with about a third of starch, was used; and no damage to the eyes followed the strewing of the mercurial powder into the eyes of the patient, as sometimes happened.

Dr. Frank, in the *Berlin Med. Wochensch.*, contributes a paper on the albuminuria of strangulated hernia. He finds that in 61.5 per cent. of such cases the urine becomes albuminous. The frequency of albuminuria in strangulation is in proportion to the severity of the latter. The lessening and disappearance of the albumen also show that the obstruction to the bowel-contents has been removed. Practically, the appearance of albumen in the urine in a case of strangulated hernia means a serious, prognostically unfavorable form of it. One should be very wary with taxis in such cases, and rather proceed to an operation by the knife. In the case where herniotomy has been performed, if the albumen disappear, one may be satisfied that the bowel-contents are again on the move.

Dr. R. Faria of Brazil is reported, in the *Rev. Gén. de Clin. et de Thérap.*, to have obtained good results from the administration of an etherial tincture of phosphorus in the pneumonia of infants, when asphyxia is threatened.

He gives a teaspoonful every hour of a mixture of eight drops of the etherial tincture of phosphorus in four ounces of cinnamon-water and sirup. It is stated that the cyanosis disappears under this treatment within twenty-four hours, the cough becomes easier, and the general condition rapidly improves. Dr. Faria adds, that the same treatment seems to give excellent results in senile broncho-pneumonia.

The *Philadelphia Bulletin*, in an article on "House-Poison," says, "If the condensed breath collected on the cool window-panes of a room where a number of persons have been assembled, be burned, a smell as of singed hair will show the presence of organic matter; and if the condensed breath be allowed to remain on the windows for a few days, it will be found, on examination by microscope, that it is alive with animalculæ. The inhalation of air containing such putrescent matter causes untold complaints, which might be avoided by maintaining a circulation through the room of fresh air."

Mr. Bailly of Paris gave to the Société de Thérapeutique an account of the methods he has tried, to render the use of the actual cautery painless. He advocates it for hydrarthrosis, incipient tuberculosis, and in certain scrofulous affections. He finds that the spray of chloride of methylene deadens the sensitivenes of the derm in from two to four seconds.

As soon as the skin whitens, the cautery may be used.

M. Glinsky recommends subcutaneous injections of ammonia in acute alcoholism. He directs to inject under the skin a mixture of one part of ammonia with two to six parts of water. Two or three minutes after the hypodermic, an erysipelatous redness is observed around the puncture, and the next morning some soreness. It is claimed that the patient, comatose from alcohol, recovers consciousness within three minutes after such an injection.

V. Lange of Copenhagen is said to have removed polypi occupying the posterior nares in four cases by the introduction, through the anterior nares, of an instrument somewhat like a button-hook with a long handle. The hook is adjusted around the pedicle with the assistance of the left index finger pressing behind the soft palate. Slight traction detached the growths.

A solution of chloroform in cold water applied to bleeding or wounded parts is recommended as a good hæmostatic.

THE HYGIENE OF PHTHISIS.

From a paper on the above subject by Dr. F. L. Flick, and published in the *Philadelphia Medical and Surgical Reporter*, we make the following selection: —

"Pulmonary gymnastics are powerful weapons against phthisis, and should be especially used by those who are unable to extricate themselves from the unhygienic surroundings and circumstances in which their necessities have placed them. Though the use of a gymnasium is very desirable for practising these, it is not necessary. The principle involved is ventilating the unused air-cells, and any combination of forced respiratory movements that will thoroughly inflate the lungs will accomplish this. Gradually filling the lungs with air whilst retracting the shoulders and extending the chest, or taking a deep inspiration whilst extending the arms above the head, and expiring whilst placing them parallel with the body, are two simple exercises which do all that is necessary, and can be taken without interfering with the most busy life, or causing fatigue. A habit should be made of thus ventilating the unused portions of the lungs, and it should be done at times when the purest air can be secured. The most practical germicide that we as yet know of for the bacillus tuberculosis is fresh air; or, more correctly speaking, it furnishes the least favorable habitat for its development. A better oxygenation of the blood is, moreover, secured by such exercises, the circulation is stimulated, and, indirectly, the digestion and assimilation improved.

"As regards the hygiene of phthisis, when the disease is once established, it is based upon the same principles as that for its prevention. Suffi-

cient nourishing food and sufficient fresh air, — these are the *sine qua non*. The prime object in every case of phthisis should be to secure a good digestion and assimilation. Every thing that is done should be done with this object in view. Good, nourishing, and easily digested food should be taken in abundance, and every care taken that the stomach be not deranged by indiscretions in eating and drinking, or by overloading. As soon as the body begins to be nourished, the lungs will improve. As an aid to digestion, outdoor exercise is very important. Without it the system cannot be made to use up a large quantity of food. Inasmuch as warm climates offer greater inducements to keep invalids out of doors, and make bedroom ventilation a little more agreeable, they are highly commendable to consumptives ; but they are by no means essential to their well-being. A cold climate will do just as well, if the patient has the courage to endure the discomforts entailed by it. It is much better that a consumptive have home comforts in the worst climate in the world, than that he be compelled to undergo the tortures of boarding-house or fourth-class hotel life at a health resort. In all warm climates the houses are built for warm-weather use, and no provision is made for the stray blizzard that occasionally comes along. Though the temperature may be very equable from day to day, there is always a marked variation between day and night. In consequence of the rapid radiation of heat, the houses become cool and damp during the night, against which there is likewise no provision, except in first-class modern hotels. In many places suitable food is difficult to obtain, even at the most extravagant prices. All in all, the average person who has consumption had better remain at home unless his home is in a large city, and then he should go into a neighboring country, where he can secure home comforts and plenty of suitable food. Let him dress warm, take outdoor exercise whenever he can, eat plenty of light, nourishing food, take ample rest and sleep, and he will get along much better in his native heath than he would with small means in the most model consumption climate. It is important that the entire body be warmly clad in cold weather. Either silk or woolleu clothing ought to be worn next to the skin. The circulation should be kept equable throughout the whole body, hence the extremities ought never to be allowed to become cold. When the feet get cold, the lungs become congested. Rubbing the body with a coarse towel has a good effect in equalizing the circulation. The ancients recognized this fact, and laid stress on it. 'Balneum alienum est,' says Celsus. Sponge baths, if carefully taken, will do good. They should, however, be taken in a warm room, and followed by a rest. Sea-voyages used to be highly recommended in the early days of medicine, and theoretically, at least, ought to be beneficial in the first stages of the disease. The ocean offers a pure atmosphere, and frequently the salt air stimulates appetite and improves digestion. In the advanced stages of the disease, they are, however, impracticable, and should never be attempted.

"Gypsy life, or travelling through the country by easy stages, and camping out, is most beneficial to consumptives, even in advanced stages. The ancients had their patients carried from place to place in chairs. In the territories most remarkable cures are brought about by this mode of living. Persons unable to walk are hauled in wagons on improvised beds, and it is astonishing what a revivifying effect constant exposure in the open air has. But, though much can be done to ameliorate the condition of the consumptive, the most important duty of the medical profession at the present day is to lend its aid in bringing about such a change in public and private hygiene as to give the disease less chance for development."

THE DOCTOR'S WIFE.

An unfortunate physician who signs himself "Cœlebs, M.D.," writes to *The Boston Medical and Surgical Journal* as follows : "Your remarks in the last issue of your valuable journal upon "The Doctor's Wife " call forth from my heart certain personal reminiscences not unmixed with pain. 'Pins,' says the infant prodigy, 'save a great many people's lives, because they don't swallow them.' So doctors' wives ruin the prospects of hundreds of us young fellows, because we don't have them. Shall I tell you my sad fate ? Two years ago, on the death of old Dr. Gamboge, two of us, as is the custom, moved into town to take his place. My friend and classmate Dr. Benedict (alas! no longer my friend) and I each arrived on the ground about half an hour after the old doctor had breathed his last. We were pretty well matched in what is popularly but erroneously supposed to be the preparation for practice, and we entered the race neck and neck. We were, as Virgil says, or might have said, *Et secare pares, et exercere parati*. Well, we took lodgings on opposite sides of the main street, and the fight began. As fast as I scored a point, Benedict scored another, and somehow his points always seemed to count for a little more than mine. I went to the brick church, which was larger; and he went to the wooden meeting-house, which had the most old families. My chimney blew down, and I got it in for a five-liner in the local paper; but the next week one corner of his house took fire, and he got it in for ten lines. I put on my door an old-fashioned knocker, and he put in an electric bell. The country people knew all about knockers, but the electric bell was something they couldn't quite grasp (figuratively, I mean; they grasped it often enough literally). Finally I fell into the common pit, and bought a horse long before I needed it or could afford it The first time I passed Benedict on the street he smiled in an unpleasant way, and said, 'Oho! I've got on to a racket worth two of that ;' and the next thing I knew, he was married. His wife distanced my horse in no time. She went to the sewing-circle, and every good patient he ever had was brought into the conversation in some way. Even if he was only called into a house to see the cook, the women all learned that he had been there, though they didn't know (for 'I mustn't talk about my husband's affairs') who the patient was. Then, when the wedding-calls were returned, into every house went some mysterious hint, not too definite, of Benedict's wonderful success. Were there any children in the family, 'The doctor is so fond of children, and they all take to him so quickly!' Had any of the household met with an accident, 'The doctor is very fond of surgery.' Were any little dresses in making, 'My husband is such a good baby-doctor ! Whatever should I do if it weren't for him !' She always found out who the family physician was ; and this information, of course, was the first and most important step toward ousting him. If a new-comer moved into town, the grocer and butcher were hardly more prompt in leaving their cards at the back-door than madam in presenting *her* business-card at the front-door. If little Susy Simmons swallowed a pin, and the horrified mother was running amuck for the nearest doctor she could find, she was beguiled in by Mrs. Benedict to wait for her doctor, whom she 'expected in every minute.' No emergency cases ever would wait for me to come home ; and whenever a patient eager for immediate healing turned away from my door, he was invariably gathered in by the siren across the way, who either entertained him till her partner's return, or else got his name booked for a visit. They were two, or more than two, to my one. It takes two men to run the Punch-and-Judy show, — one to work the figures, the other to do the talking, get in the crowd, and take up the collection. I had to run my show alone, and didn't take up much money. I wonder if King Lemuel's mother did not have such a doctor's wife in mind when she told him the memorable story of the virtuous woman. There are certain internal evidences that she did. 'She perceiveth that her merchandise is good : *her candle goeth not out by night*. . . . Her husband is known in the gates, when he sitteth among the elders of the land.' By the way, Mrs. Benedict has already got her husband on to the school committee, and I hear is thinking of sending him to the Legislature next year. There is nothing left for me but to move on and try it somewhere else. *Væ victis!* I fondly thought, when I spent my money for a horse and carriage, that I held the 'right bower ;' but I have found that Benedict has the 'joker.' And now, before trying my fortune in a new field, I must have, cost what it may, a wife. Bitter experience, as well as the tenor of your editorial, convinces me of it."

ON MEASURING LIQUIDS BY DROPS.

The size of drops depends upon the form of the surface from which they hang. The following experiments were made with a hundred-grain pipette. The number of drops in burettes varies with the position of the stopcock. A pipette was therefore preferred.

1. The number of drops increases with the time taken, thus: —

Water at 2° C., about ½ drop per second,	141	drops.
" " 2 or 3 drops "	136	"

2. The number of drops increases with the temperature. For example, —

Water at 170° F.	2 or 3 drops	per sec.,	156	drops.
" 160° F.	"	"	155	"
" 150° F.	"	"	154	"
" 140° F.	"	"	153	"
" 130° F.	"	"	152	"
" 120° F.	"	"	151	"
" 110° F.	"	"	150	"
" 100° F.	"	"	148	"
" 90° F.	"	"	147	"
" 80° F.	"	"	145	"
" 70° F.	"	"	143	"
" 60° F.	"	"	141	"
" 50° F.	"	"	139	"
" 40° F.	"	"	137	"
" 32° F.	"	"	135	"

Near the freezing-point every 10° F. is increased by two drops, at higher temperatures by one drop. The number of drops decreases rather more rapidly near the freezing-point.

3. The number of drops is increased when a substance is in solution: —

Saturated solution of ammonium oxalate at 4° C., 2 or 3 drops per second	139 drops.
Saturated solution sodium phosphate at 4° C., 2 or 3 drops per second	138 drops.

The following are some other liquids at 12° C. at the rate of about two drops per second: —

Absolute alcohol	387 drops.
Ether	452 "
Carbon disulphide	428 "
Sulphuric acid	340 "
Hydrochloric acid	182 "

This method may be used in determining the relative quantities of alcohol and water in mixtures of these liquids. — A. F. Reid, *in Chemical News*.

A CHINESE MEDICINE ADVERTISEMENT.

The *North China Herald* gives the following as a translation of an advertisement in a native paper, commending the "Fairy Receipt for Lengthening Life Pills." "The receipt for these," declares the advertiser, "has come down to us from the physician Hsü Ch'un-fu in the time of the Ming dynasty. A salt controller, Ch'ên-ta-jen, was journeying on the Ch'ing-ch'êng Hill, when he saw a woman passing southwards over the mountain-tops as though flying. Her age was about thirty; and in her hand was a stick, and she was pursuing an old fellow of a hundred years. The salt controller asked the woman, 'Why do you beat that old man?' She answered, 'He is my grandson, for I am five hundred years old, and he a hundred and eleven. He will not purify himself or take his medicine, and so I am beating him.' The salt controller alighted from his horse, and knelt down and did obeisance to her, saying, 'Give me, I pray, this drug, that I may hand it down to posterity for the salvation of mankind.' Hence it got its name. It will cure all affections of the three intestines, and derangements of the seven emotions, constitutional debility, feebleness in moving about, dimness of vision, rheumatic pains in the loins and knees, and cramp in the feet. A dose is two mace. Take it for five days, and the body will feel light; take it for ten days, and your spirits will become brisk; for twenty days, and the voice will be strong and clear, and your hands and feet supple; for one year, and white hairs become black again, and you move as though flying. Take it constantly, and the hundred ills will vanish, and you will pass a long life without growing old. Price per bottle, $1."

MEDICAL MEMORANDA.

It is not an uncommon thing to have the temperature of a typhoid-fever patient rise as much as two degrees when a storm is approaching, and then revert again when the storm is settled or over.

Wash to Perfume the Breath. — Cloves bruised in a mortar, three teaspoonfuls; boiling water, one pint. Infuse for an hour in a covered vessel, exactly as in making tea; when cold, decant or filter through coarse muslin. Wash the mouth with it as often as may seem necessary.

A New Local Anæsthetic. — Professor Wilhelm Filehne of Breslau has discovered that the union of tropin, a molecule derived from atropia, with benzoic acid, produces a substance which he names *benzoyltropin*. He states that it produces an "exquisite local anæsthetic effect." It has also mydriatic power, paralyzing the accommodation. Filehne states that it is the benzoyl molecule in cocaine which is the active agent. Benzoyltropin is the nearest approach to cocaine. It is much higher in price, and has greater mydriatic power.

A New Military Ration. — All the garrisons within the limit of the Seventh German Army Corps have now been provided with larger samples of the new article of food which is in future to form the so-called "iron ration" of the men in the field. It is a peculiar kind of bread, in the shape of small cubes the size of a chocolate drop, made of fine wheat bread, strongly spiced, and calculated to keep for a long time. When taken into the mouth it quickly softens, and is both palatable and nutritious. It is chiefly intended for forced marches, when there is no time for camping and cooking.

Very Old Age. — The death is reported from Constantinople of a man named Dimitrios Antippa at the extraordinary age of one hundred and fifteen years. The deceased was born at Cephalonia in 1772; and, though in his later years he settled down as a merchant in the Turkish capital, he had passed his earlier days in Paris during the Reign of Terror, having had among his personal friends Marat, Danton, and Robespierre. To the last, M. Antippa retained his clearness of intellect.

Toilet Vinegar. — Oils of lavender, rosemary, juniper, peppermint, cinnamon, of each four ounces; oil of lemon, oil of cloves, of each eight minims; alcohol, three fluid ounces; pure acetic acid, four fluid ounces; water, q. s., to make sixteen fluid ounces. Dissolve the oils in the alcohol, add the acetic acid, and then enough water to make sixteen fluid ounces in all. Set the turbid mixture aside for a few days, occasionally shaking it up, and afterwards filter through good filter-paper.

Alcohol in Wine. — It may be laid down as a rule that wine containing more than 13 per cent of alcohol is fortified, especially if, as in sherries, the alcohol is from 15 to 20 per cent, and in the case of port is from 17 to 21 per cent. The average amount of alcohol in the French red wines is 10.44 per cent, and in white, such as champagnes, about 11 per cent; in hocks and Moselles, about 10 per cent; in Spanish wines, about 17 per cent; in ports, 17 or 18 per cent; in Madeira, 16 or 16.1 or 16.2 per cent.

HUMORS.

"Why, Pat! for Heaven's sake, what is the matter?" — "Well, sorr, I swallied a pertater-bug; and although, sorr, I took some parrus-green widin five minutes after, ter kill th' baste, shtill he's just raisin' th' devil inside o' me, sorr."

An Exchange says: "They all call it 'mind-cure' in Boston and 'voudooism' on the Southern plantations; but about the only difference is in the name and in the fact that the voudoo charges less.

Desperate. — *Physician* (to patient): Your case is a very serious one, sir, and I think a consultation had better be held.

Patient (too sick to care for any thing): Very well, doctor: have as many accomplices as you like.

A Miser, troubled with heart-disease, finally decided to call a physician. After the preliminary examination, the patient asked: "Doctor, how much is it going to cost?" — "Not a sou." — "Thanks; but you're too kind. I ought not to" — "Oh don't you trouble yourself. Your heirs will see that I am paid."

Elderly Man (staring at immigrant who has just landed): What a singular-looking person! His face is all covered with little depressions. Was he born that way, do you think? or was he captured by savages, and mutilated?

Bystander: Captured, nothing! That man once had the small-pox, that's all. Didn't you ever see a man pitted like that before?

Elderly Man: Small-pox? Ah, that is something like cholera, is it not?

Bystander (impatiently): Jumpin' Jerusalem, man! where have you lived all your life?

Elderly Man (with dignity): Sir, I am a member of the New York City Board of Health.

A Prominent Physician tells the following good story of his early struggles in his profession: "I insinuated to my reverend friend how advantageous it would be to me if he would notice my being called occasionally out of church, and he did. Dr. Grosgrain, my chief competitor, wanted some too, and he also insisted on receiving clerical attention. The next Sunday an office-boy came running into the building, and whispered to my opponent, who immediately left. The pastor, who was about to begin his sermon, hesitated, and then said: 'Brethren, let us pray for a sick man who is in great danger: Dr. Grosgrain has been called to see him.' This settled the doctor, and left the field to me."

The Popular Science News.

PUBLISHED MONTHLY BY THE

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Manager.

Publishers' Column.

Back Number wanted. — Full price will be paid at this office for a copy of the *Boston Journal of Chemistry* for November, 1879. Address the publishers of this paper, 19 Pearl Street, Boston.

Dr. W. A. M. Culbert, Newburgh, N.Y., writes: "Colden's Liquid Beef Tonic is an excellent article for the purposes for which it is offered. I recall patients by whom it was taken with eagerness and great benefit after domestic beef teas and other beef preparations had become repulsive."

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Dr. L. Waite, Pittsfield, Mass., says: "It gives me much pleasure to express the satisfaction I have derived from the administration of Horsford's Acid Phosphate. It has been found to be particularly efficacious in chronic dyspepsia as well as in those conditions of the system where there is loss of nerve-power. From its use for a period of about eight weeks, to the exclusion of all other remedies, I attributed the restoration of health of a patient who was emaciated to the last degree in consequence of nervous prostration and dyspepsia. This patient's stomach was in such an irritable condition that he could not bear either liquid or solid food. An accomplished physician of many years' experience, whom I called in consultation, pronounced his case an incurable one. At this stage I decided to use Horsford's Acid Phosphate, which resulted as above mentioned."

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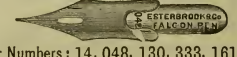

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CONTENTS.

FAMILIAR SCIENCE. — The Limitations of our Knowledge . 49
On the Study of Nature ... 49
The Making of the "Origin of Species" ... 50
Botany as a Recreation ... 51
Ferns ... 52
Scientific Brevities ... 52
PRACTICAL CHEMISTRY AND THE ARTS. — Platinum ... 53
Preparation of Peroxide of Hydrogen on a Large Scale ... 53
Scientific Railroad-Building ... 53
A Simple Thermoscope ... 54
Electric "Sunstroke" ... 54
A Much-Needed Invention ... 54
Chemical Notes ... 54
Practical Recipes ... 54
HOME, FARM, AND GARDEN. — The Growth and Decay of Rocks ... 55
Stable Management ... 55
Selected Recipes ... 56
Care of Lamps ... 56
Gleanings ... 56
EDITORIAL. — An Ancient Japanese Fort ... 57
Recent Feats in Photography ... 58
Paris Letter ... 58
Meteorology for February, 1888, with Review of the Winter ... 59
Astronomical Phenomena for April, 1888 ... 59
Where did they Come from? ... 60
A Curious Electrical Phenomenon ... 60
Questions and Answers ... 60
Literary Notes ... 60
MEDICINE AND PHARMACY. — The Natural Food of Man ... 61
"The Catarrh" ... 61
Monthly Summary of Medical Progress ... 62
Medical Miscellany ... 63
Patent Medicines ... 64
Medical Memoranda ... 64
Humors ... 64
PUBLISHERS' COLUMN ... 64

Familiar Science.

THE LIMITATIONS OF OUR KNOWLEDGE.

IN the wonderful advance of scientific knowledge during the last hundred years, we are likely to overlook the many fundamental laws and phenomena of the natural and physical world of which we still remain in utter ignorance. We pluck the fruit from the wide-spreading branches of the tree of knowledge, but its roots remain hidden from our sight. The action and effects of the forces of nature are constantly becoming more and more familiar to us, and it is on this line that most of our progress has been made; but as to the nature of the forces themselves we are still ignorant.

The constitution of matter has been a subject of dispute from the time of Aristotle, and it is not too much to say that we have no more absolute knowledge on this point than had Aristotle himself. Starting from the supposition that matter is not continuous, but made up of disconnected atoms or particles of definite size and weight, a most beautiful theory has been evolved which perfectly explains all the observed chemical and physical phenomena; but what chemist will venture to maintain the atomic theory as an actual and provable fact, in the face of the many difficulties which such a conception of matter involves?

The nature of light and heat is another question which is even more difficult to answer than the constitution of matter. They are certainly immaterial, possessing neither weight nor volume. The modern theory considers them as a force, or mode of vibratory motion in a hypothetical substance called *ether*. But the existence of the ether has never been proved; and, in fact, if it does exist, it must possess properties varying widely from any forms of matter with which we are acquainted. All that can be said is, that, granting its existence, the phenomena of light and heat admit of a ready explanation.

Electricity is another substance concerning the nature of which we know absolutely nothing. To the question, What is electricity? there is but one answer, — We do not know. We do know what it will do, and can make it serve us in an infinite variety of ways; but the most learned electrician is only in the same position as that of a little child who can move the lever which controls a great engine, but knows nothing of its construction, or how the the motion is produced.

Chemical affinity offers a multitude of perplexing questions which as yet no one can answer. Why does the oxygen of water leave the hydrogen to which it is joined, to unite with the sodium which is brought in contact with it? Why are the proportions in which the different elements unite among themselves, fixed and invariable? Why does fluorine combine so strongly with every known element but one, while nitrogen, when forced into combination, confers an element of weakness upon the entire compound? No one has yet answered these and innumerable similar questions.

But the greatest mystery of all, and one of which we know the least, is that of the nature of life and mind. There is no appreciable difference between a mass of dead and living matter. It is only in the possibilities inherent in the two forms that we can recognize the difference. An animal grows, and so does a crystal; but no one would be likely to mistake one process of growth for the other. From the immense mammoth down to the microscopic bacterium or plant-spore, all are possessed of something we call life, which, as long as it exists, possesses the power of reproducing organisms similar to itself. We can, apparently, destroy this mysterious principle, but we cannot bring it back; and it is not probable that, in our present condition of existence, we shall ever know any thing more regarding it. Some patient student of nature may be able in future years to give us absolute proof of what matter, light, electricity, and chemical affinity really are; but he who succeeds in imparting to the minutest quantity of dead matter the wonderful vital force, will have accomplished a greater and more wonderful work than all who have preceded him, and one which, as far as we can see at present, is beyond the range of human possibility.

[Original in *Popular Science News.*]

ON THE STUDY OF NATURE.

BY PROFESSOR N. S. SHALER.

II.

THE degree to which the questioning of nature may be associated with the occupation of a man must manifestly vary in a great measure according to the nature of his vocation. Thus, in the case of the physician, his life's work is properly bound up with the task of continuously interrogating nature, while with the lawyer it is at first hard to see where his contact with the environing world is to take place; the nature he finds in his occupation is of the strictly human sort, and that by no means in its best aspect. Nevertheless, the principles of proof rest upon the most fundamental truths of the universe; and the man of the law who is a philosophical student of evidence, and who extends his studies of that field over a wide realm, necessarily becomes in the best sense a naturalist. Although Greenleaf and Starkey had no intention of writing a book for the naturalist, all students of nature may find great profit from the study which they have given to the principles of evidence. In truth, we may say that in its best form the methods of legal inquiry are profoundly naturalistic, though they take in but a small part of the field of nature. The education of the clergyman, if it be such as to fit him for the great burden which comes with the modern conditions of theology, must lead towards the sense of nature; as one to whom is given the cure of souls, his first duty is to seek the resources which may lead to the reconciliation of the human spirit with the universe in which it dwells. Whatever else is to come to our modern theology, it is clear to all that it must found at least a part of its foundations in the world of visible fact. Above all, men need to be reconciled to their conditions: and in no other way can these be secured save by showing them the moral dignity and beauty of the nature about them. Every clergyman should feel in some tangible way the conditions of this visible world, and be prepared to aid those under his care to gain the peace which that understanding may give.

The less learned employments commonly known as trades afford in most cases a tolerable opportunity for the training of the worker in the understanding of natural phenomena. The most common and the most generalized of these employments is that of the farmer. Fortunately for the interests of the better culture, more than one-half of the men and women of the world must always be in contact with the soil, — with that realm where nature is most active, and where she teaches the most. There are no essential changes of conditions necessary to facilitate natural inquiry in this field of employment. Every farmer is perforce a naturalist. We need only change the way in which he approaches

his tasks, replacing in a measure the tradition and prescription by the spirit of observation, in order to secure the end in view. It is, of course, not desirable in any way to separate the tiller of the soil from the vast fund of knowledge which has come to him by the experience of his predecessors. What is needed is, that he should be informed concerning the nature of the creatures with which he deals, that he should know the laws of plant-life and of animal function, so that he does nothing unintelligently or without the sense of the truth which is before him. From this creation of the spirit of inquiry we may not only hope for a new mental state in the agriculturist, but for a vast measure of benefit in the economic results which he seeks to attain. A purely traditional agricultural art at best suits the narrow range of conditions of the folk whose crops have not changed, and who till the same soil and the same climate as those who have accumulated the store of experience. Particularly in this country, where the farmers generally occupy territories recently won to tillage, is it necessary to have the motive of research as well as the capacity for it well developed in order to secure the best profit from the soil.

All the other occupations in which the man acts from his individual motive are likewise suited for the training necessary to develop the capacities of the naturalist. The blacksmith, the carpenter, the mechanic in charge of engines of all descriptions, can be taught to find his way to natural law through his daily experience. The ordinary household duties of women are so varied, and at so many points come in contact with natural phenomena, that it seems to me clearly possible to lift their occupations above the plane of mere routine in which they now lie. In fact, with the exception of the lower grades of factory hands, where the work is extremely routine-like in its character, there is reason to believe that, with a proper system of training, one in which the education given the laborer is largely with reference to his life's employment, we may be able in the course of time to effect a very great change in the relations of culture to life. We may make men and women feel the comforting sense which comes from the understanding of the world about them. There remains unhappily a great body of toilers, those engaged in the purely routine employments, that have no actual contact with nature, where it does not seem possible to afford any training in science which will directly bear upon their vocations.

One of the great advantages arising from the use of machinery in our arts is, that in time we may hope to have all those engaged in mechanical employments in charge of engines, the natural forces supplying the energy, and the man or woman the thought alone. When this position of the arts is attained to all, artificers will be in a position to receive the benefits of the training substantially like that to which the naturalist attains. If we teach a youth a machine, the principles of its structure, the process of its evolution, the nature of the force involved in its operation, we make him an inquirer. The field of his inquiry is less extensive than that of the astronomer or the geologist, but the principles are essentially the same; and the effect on the character and intellectual development is of the same order as that which the most favored naturalist receives.

It will be manifest to the reader that the accomplishment of this training in the arts of inquiry as applied to the occupations of life, demands a very considerable reconstruction in our system of education. In certain respects the change will have to be of a radical sort, but the profit which will come from a modification in our theory of teaching will be so great as to warrant the cost of the changes. The most serious difficulty which besets the education which we now give to those who have to look mainly to labor for their support, arises from ancient prejudices with reference to liberal culture. In the first stage of our modern education, the universities were the end for which all education was given to boys. The languages and mathematics were required for admission to the colleges, and so the first primary schools led upward towards them. With the extension of the public-school system, although the training was no longer destined to carry the student to the universities, its form remained essentially unchanged. Thus the ideal of our high schools is that of the university reduced in the measure which the limited time allowed for the student's intellectual training will permit. The standards of education were those required to fit the student for the practice of the learned professions. The body of natural science did not exist. There was nothing else to be taught save those branches of learning which still remain the principal resources of our secondary schools. The modern development of science, and the close relations of that division of learning to the practical affairs of life, have made it possible to create another scheme of education, a scheme in which almost all men can have a share of culture which may abide with them for all their lives.

I would not have the reader suppose that I am advocating the abandonment, in the education of those who cannot attain to the universities, of all the liberal culture which may be attained to from the study of the mother-tongue and its literature, or from the elementary training in mathematics, nor would I willingly give over the training in the elements of geography or of history. I would, however, have our educators recognize the fact that the greatest result to be attained from schooling is an enlargement in the methods of dealing with the affairs of life. To accomplish this result, it is absolutely necessary that the burden of our education must have direct reference to the work which the individual boy or girl is to do in the world. At present the good effects of education are generally arrested if not destroyed by the introduction of the youth to the practical affairs of life. I would have the education proceed in such a manner that the adult would necessarily go forward in daily labor on the lines which were already strongly indicated in his preliminary training.

The importance of this general principle has of late been recognized by those who are endeavoring to attach systems of industrial training to the education given in our common schools. The reformers who are endeavoring to accomplish the end in this manner have acted on the supposition that it was possible in the curriculum of a school to give a general training in the principles of practical mechanics and in the use of tools, by which the youth would come to his life's task, at the end of his schooling, essentially prepared to maintain the educated spirit in his work. The principal difficulty of this system arises from the fact that the student cannot have the sense of actual work in the school laboratory which it is necessary to bring him to in order to confirm his relations to the avocation he is to follow. So far, the project of separating the training in the arts from the actual pursuit of them has not, it appears to me, been successful. The reason of the relative failure is doubtless to be found in the lack of actuality which must characterize the work in the workshop which is a mere appendage to the school. In a subsequent paper I shall undertake to set forth the methods of teaching by which I think we can hope to bring the spirit of inquiry into the ordinary employments of men.

[Original in *Popular Science News.*]

THE MAKING OF THE "ORIGIN OF SPECIES."

BY K. B. CLAYPOLE.

The long-expected *Life of Charles Darwin* is now before the public, and there are few people of ordinary cultivation who will not find pleasure in its perusal. In the choice of materials and their arrangement Mr. Francis Darwin has with rare skill consulted all tastes; illustrating the personal character of his father, giving an insight into the daily life of the great naturalist, and recording the history of that theory of the origin of known organic forms which has regenerated biological science, and made itself felt in every department of modern thought.

What was there in Darwin, that it was given to him to find the hypothesis for which the whole scientific world was waiting? What in the circumstances of his life to shape his thoughts to such an end?

Charles Darwin, like his grandfather, Erasmus, possessed an indomitable love of hard mental work, and a "vividness of imagination" which led to an "overpowering tendency to theorize and generalize." In Charles this tendency was kept in check by great powers of observation and attention to details, inherited from his father, Dr. Robert Darwin of Shrewsbury. To his father, also, he owed a good memory, confidence in his own observations, even if opposed to current opinion, and a remarkable ability to find cause from effect; while the rare patience and persistent industry which enabled him to accomplish an enormous amount of intellectual work, notwithstanding continuous physical suffering, may well have descended to him from Josiah Wedgwood, his mother's father.

In his own analysis of his mental qualities Darwin finds that the most important to him as a scientific worker were, "the love of science, unbounded patience in long reflecting over any subject, industry in observing and collecting facts, and a fair share of invention as well as of common sense." To these his son adds "the power of never letting an exception pass unnoticed," with the "special instinct of arresting it, and seizing on it as a new point of departure." To these mental qualifications for scientific research one other condition of success was added to Charles Darwin, — leisure." "I have had," he writes, "ample leisure, from not having to earn my own bread."

Looking back on the early days of his life, Darwin found that at eight years old his taste for natural history was so far developed, that he tried to make out the names of plants by examining their flowers, and to account for the changes in the colors of primroses and polyanthuses — not always, however, with a strict regard for truth. He had also a passion for collecting shells, seals, coins, minerals, — any thing and every thing that interested him. These tastes he considered innate, as, not being shared by brothers or sisters, they arose without the stimulation of example. Nor were they at any period encouraged by his instructors, who regarded their indulgence as trifling and waste of time, and whose methods of teaching were calculated to destroy all but the most vigorous powers of observation and reasoning. In after-life Darwin said of his thirteen years of regular instruction, "I consider that all I have learnt of any value has been self-taught."

Collecting minerals, observing insects, and noting the habits of birds, were means of self-education during his boyhood; but the most important lesson of the period was learned in working with his brother Erasmus at chemistry in

a laboratory adapted from the garden tool-house, and in reading with care several books on the subject. "This," he says, "was the best part of my education at school, for it showed me practically the meaning of experimental science."

During his two years in the medical school of Edinburgh University, Darwin made the acquaintance of several young men fond of natural science, and contributed to a natural-history club among the students one or two interesting little zoölogical discoveries made while dissecting, without any regular training, and with a "wretched microscope," specimens found in the tidal pools or dredged from the sea. From one of his friends he heard enthusiastic eulogy of Lamarck and his theory of evolution, which derived all the plants and animals now living, including man himself, from pre-existing simpler forms, by a process of slow and gradual modification of structure and instinct produced by the effort of the individual to adapt itself to a change in the conditions of its life. Darwin had previously read similar views in the *Zoonomia* of his grandfather, Erasmus Darwin; and though he paid little attention to them at this time, he thought long afterwards that the hearing of them maintained and praised early in life may have favored his upholding them under a different form in the *Origin of Species*.

The careful study of the works of Paley, the public botanical lectures of Professor Henslow, field excursions with the botanists of the University, and collecting beetles with eager entomologists, were among the educational influences of Darwin's three years at Cambridge. Of these the most potent in its after-effects was the friendship formed with Professor Henslow, a man of well-balanced mind, great knowledge of the natural sciences, and a strong taste for drawing conclusions from long-continued minute observations. At the house of Professor Henslow, Darwin met many of the most distinguished men of the University, whose varied and brilliant conversation stimulated his mental activity and ambition. These were, moreover, nourished by the careful reading of Humboldt's *Personal Narrative* and Sir J. Herschel's *Introduction to the Study of Natural Philosophy*, "which books," he says, stirred in him "a burning zeal to add even the most humble contribution to the noble structure of natural science."

Up to the time of his leaving Cambridge, in 1831, science had been to Darwin but one of the many recreations of a happy, careless life, contributing but indirectly to the education of his mind. His first real scientific training was gained when, as Naturalist to the Beagle, he was forced to attend closely to several branches of natural history, to bring into play powers of reasoning as well as of observation, and to make every thing about which he "thought or read bear directly on what he had seen or was likely to see."

In the early part of the voyage he read with care the first volume of Lyell's recently published *Principles of Geology*, in which a great mass of facts was brought forward to support the principle that the changes in the past geography of the globe were wrought by the same forces which we see at work in the present, — a principle which, though subversive of all the "world-wide catastrophes" dear to the geologists of the period, was recognized to be true by Darwin as soon as an opportunity came to put it to the test.

World-wide catastrophe having been eliminated from the history of the earth, there remains no cause for the sudden extinction of one set of organic forms and the substitution of another by special creation. Lyell was quite aware of this; but so long as the gradual derivation of one species from another remained a mere logical deduction, with no better support than a suggestion from the brain of the gifted Lamarck, he, like other scientific men at that time, hesitated to express himself positively on the subject.

Having grasped the principle of uniformity, Darwin could not but see that consistency demanded its application to the whole realm of nature, organic as well as inorganic. His belief in the theory of special creation was shaken, and before the end of the voyage it was destroyed forever by finding in South America fossil remains of gigantic armor-clad animals allied to existing armadillos of the same continent. Being also much impressed by the resemblance between the productions of the Galapagos Archipelago and those of South America, and the differing slightly of those productions from island to island, it became evident to him that these and many similar facts could be explained only by a gradual modification of species. At the same time, it seemed to him that changes in surrounding conditions, such as climate, food, etc., could not alone account for all the adaptations of organisms to their mode of life, and that Lamarck's addition of effort on the part of the organism was inapplicable in the case of plants. The subject, he says, haunted him; and shortly after his return to England he determined to follow Lyell's example in geology, and collect from the whole organic kingdom, and on a wholesale scale, all facts bearing in any way on the question of species.

As it seemed to Darwin that light might be thrown on the problem by a careful study of domesticated animals and cultivated plants, he sent out printed inquiries whenever information promised to be forthcoming, plied his friends with questions, conversed with skilful gardeners and breeders, and read and "abstracted" an immense number of books, journals, and transactions. He soon perceived, he says, that selection was the keystone of man's success in making useful races of animals and plants: but how selection could be applied to organisms living in a state of nature, was inexplicable to him until, in October, 1838, happening to read for amusement *Matthus on Population*, and being well prepared to appreciate, from long-continued observation of the habits of animals and plants, the struggle for existence which everywhere goes on, it at once struck him that under these circumstances favorable variations would tend to be preserved, and unfavorable ones to be destroyed; and the result of this process continued through untold time would be the formation of species. "Here, then," he says, "I had got a theory by which to work."

But so anxious was Darwin to keep his mind free from prejudice at this early stage of his inquiry, that it was not till the summer of 1842 that he allowed himself to write even the shortest sketch of his theory. This sketch, somewhat enlarged in 1844, was again set aside until, having tested his hypothesis by nature, thought, extended observations, and abundant experiment, he should feel justified in offering to other scientific workers "natural selection" acting through the "struggle for existence" as the basis of organic evolution. This caution and self-restraint were not without reward; for when at last, in 1859, Darwin gave his results to the world, no critic, however hostile, was able to bring forward a single objection that had not already been considered, while the clear reasoning and striking illustrations with which his views were presented had no small share in producing that change in the aspect of biological science which is one of the wonders of the nineteenth century, and the direct and necessary outcome of the *Origin of Species*.

[Original in *Popular Science News*.]

BOTANY AS A RECREATION.

BY FREDERICK LEROY SARGENT.

IV.

PHYSIOLOGICAL BOTANY.

In the study of plants from a physiological stand-point, the main endeavor is, to discover how they live, the details of their structure, and the uses or significance of their several parts. The various questions which are thus involved must be answered by different means, — sometimes by performing experiments, and sometimes by studying form or construction.

For the encouragement of those who would rather study plant-life than plant-names, it may be said that such a general acquaintance as most persons possess of the common names of common plants is quite sufficient for the needs of a beginner in physiological botany. Proficiency in systematic botany is, of course, very helpful in the study of plant-life, and in most of the books to which we shall refer, the student will find that a knowledge of names is constantly presumed; still, the knowledge called for is mostly of a kind that, when needed, can usually be easily obtained by reference to a dictionary or to a general systematic work.

The principle of verification, which we have already advocated in systematic botany, is especially valuable for a beginner in physiological studies. At the outset, the most profitable as well as the most enjoyable manner of working is to read some good book, and attempt to see for one's self, as as much as possible, of what is spoken of, — repeating the experiments described, and hunting up examples of the structures that are mentioned. A most fertile source of pleasure is, however, neglected if the student does not extend his investigation beyond mere verification. Books can at best tell only what has been already learned on a given question; and to an intelligent student there will be suggested interesting ways in which this knowledge may be extended, and thus he will be led to supplement his verification studies by the delights of independent work.

In the study of animals, it has long been understood that the various organs of their bodies are adapted, often in a most beautiful way, by their form and other qualities, to fulfil those offices which the welfare of the animal requires. Thus, in our conception of a bird there enters an idea of the wonderful mechanism of flight; the ways in which lightness and strength are secured in the skeleton; the form of the feet as adapted for perching or wading or swimming, as the case may be; the shape of the bill, as fitting it for a special use; and a number of other adaptations of means to ends by which the creature is fitted to the conditions under which it lives. In plants it has been only within comparatively recent times that adaptations to environment have been recognized; but to-day such considerations hold a promiuent place in the minds of botanists, and offer one of the most attractive fields upon which a student can enter.

For the most part, there is no need of other than the simplest apparatus; and for much of the work, none at all is required. In the matter of books, the student in this field is especially fortunate, for it would be hard to find more delightful scientific literature than has appeared of late years in this department.

As particularly useful for beginners, we can recommend Gray's *How Plants Behave*, a charming little book, written for young people, but fully worthy of older readers; and Lubbock's *Flowers, Fruits, and Leaves*, and *British Wild*

Flowers considered in Relation to Insects, which, although not at all juvenile, are popular in the best sense of the word, and will be found thoroughly enjoyable. The same may be said of Kerner's *Flowers and their Unbidden Guests*. Mueller's *Fertilization of Flowers*, a voluminous book, is especially valuable as a practical aid to the more advanced student.

Several of Grant Allen's books will be found particularly useful for their suggestiveness. Such are his *Vignettes from Nature*, *Colin Clout's Calendar*, *Evolutionist at Large*, *Flowers and their Pedigree*, and *The Colors of Flowers*. These are all light reading, and are well calculated to supplement the other books in a very pleasant way.

The man of all others who has done most to advance this department of botany is Charles Darwin, and it would be impossible to set before the student a more perfect model of careful experimenting, keen observation, and clear reasoning, than is afforded by his invaluable works. The simplicity of the apparatus and the methods which he used in the prosecution of his researches not only excites our wonder and admiration, but puts it easily within our power to repeat many of his experiments, and so observe for ourselves some of the most marvellous phenomena of plant-life. The following are his principal botanical works: *Insectivorous Plants*, *Climbing Plants*, *Power of Movement in Plants*, *Fertilization in the Vegetable Kingdom*, *Fertilization of Orchids*, *Forms of Flowers*.

So far in our consideration of physiological botany we have referred only to such matters as admitted of practical study, without, as a rule, involving the use of the compound microscope or other elaborate apparatus. There remains now a portion of the subject which presents greater difficulties in practice, as it grapples with some of the profounder secrets of nature. These more advanced parts of physiological botany we may divide into microscopical anatomy, and physiology proper.

A most valuable text-book, comprising both divisions, and with copious references to highest authorities in the several departments, will be found in Goodale's *Physiological Botany*. In the introduction, much practical information is given regarding the use of the microscope; and in an appendix, directions are offered for performing many of the most important experiments mentioned in the book.

Strasburger's *Practical Botany* deals exclusively with the microscopical side of the subject, and, for the field it covers, cannot be too highly recommended. Strasburger is one of the most thorough masters of microscopical technique that ever lived, and he has the rare gift of imparting in the clearest way just such information as a student needs, to arrive at satisfactory results.

Finally, we may recommend as a thoroughly readable account of physiology proper, Vine's *Lectures*, which embodies the latest views on the subject.

It will be unnecessary for us to add more titles to what we fear may have already proved to be a rather tedious list, although many books deserving of mention have been omitted. We trust that enough has been said to enable any one to make a good beginning in these lines of study, which must prove a source of lasting pleasure to all who pursue them in a proper way.

We are far from believing that the study of botany is inherently more interesting than any other department of science: but there are certain tastes to which it will more strongly appeal, and certain circumstances under which it will be the most fitting study; and when this is the case, we feel confident that the student will have no cause to accuse us of having exaggerated the pleasures of botany as a recreation.

[Original in *Popular Science News*.]

FERNS.

Ferns belong to the higher *Cryptogamia*, and are distributed all over the world, excepting the polar regions. They are beautiful and attractive, but the question is asked by those who prefer the useful to the ornamental, "What are their uses?"

Amid the dearth of uses, it is said that in India and New Zealand several kinds were used as food; and in the north of Europe starch was made from the roots of the *Osmunda*, and bread from those of the *Bracken;* and that in the time of Henry VI. the people of England were reduced to the use of this bread.

The ancients used the roots and whole plant in decoctions for all kinds of chronic diseases, and in some countries the stalks of the *Bracken* were used in the place of straw for thatching.

All of the common ferns are sweet morsels of food to donkeys in the pasture, and dried, they pick them out as dainty bits among the hay.

Many varieties of ferns are useful in the arrangement of cut flowers. Used among the exotics, nothing can exceed the beauty of the *Adiantum*, or maiden-hair, in its grace and delicacy; and growing in its native haunts, beneath the rich, shady woods, its only rival is the *Lygodium*, or climbing fern.

The *Athyrium* or lady-fern, "in all her graceful power," is a favorite with poets. Scott thus describes its hiding-places: —

> "Where the copsewood is the greenest,
> Where the fountain glistens sheenest,
> Where the morning dew lies longest,
> There the lady-fern grows strongest."

W.

SCIENTIFIC BREVITIES.

Leaden pipes for the conveyance of water were brought into use in 1236.

Cavendish, in 1766, discovered hydrogen; and between 1774 and 1779 Priestley discovered oxygen, azote, and nitrous gas.

Forests and Rainfall. — In concluding a paper in *Science* upon the question whether forests influence rainfall or not, Henry Gannett says: "It seems idle to discuss further the influence of forests upon rainfall from the economic point of view, as it is evidently too slight to be of the least practical importance. Man has not yet invented a method of controlling rainfall."

Etruscan Antiquities.— A fine glass vase, just discovered in an Etruscan tomb at Bologna, is of a sea-green color, like a soda-water bottle, thick and of a unique form, with two handles. It is nine inches high, and without ornamentation. There is not a single defect, flaw, crack, or chip about it. With it was found an ivory chair made after the fashion of a modern camp-stool, having all its screws and rivets still in perfect condition, and a small casket containing beads and some very elegant articles in bronze. The articles are supposed to date from the fifth century. The tomb in which they were found was closed at the top by an enormous globular mass of stone, as fresh as if it had been fashioned only yesterday.

Geological Work of Marmots.— Professor Mushketoff's account of his explorations in the Caspian steppes contains some interesting remarks on the work done by marmots (*Spermophylus Eversmanii*) in the modification of the surface of the steppe. They made their appearance in the region only a few years ago, but their heaps of earth already cover hundreds of square miles. Like earthworms, they must therefore be regarded as a factor of some importance in modifying the surface of the soil. Their heaps of earth have an average length of 3½ meters, and a width of 2½ meters, with an average height of from 30 to 50 centimeters, and it was found that on each 2 square meters there were no less than five, seven, or even eight heaps, each of which represented at least 2 cubic meters of earth removed. It may be safely asserted that on each square kilometer of surface no less than 30,000 cubic meters of earth have been brought to the surface, owing to their activity. Their influence on vegetation is also well worthy of notice.

Diamonds in Meteoric Stones. — In a Russian paper appears a preliminary report of the examination by Latschinof and Jerofeif, professors of mineralogy and chemistry respectively, of a meteoric stone weighing four pounds, which fell in the district of Krasnoslobodsk, government of Penza, Russia, on Sept. 4, 1886. In the insoluble residue small corpuscles showing traces of polarization were observed; they are harder than corundum, and have the density and other characters of the diamond. The corpuscles are said to amount to one per cent of the meteoric stone. Carbon in its amorphous graphitic form has been long known as a constituent of meteoric irons and stones; lately small but well-defined crystals of graphitic carbon, having forms often presented by the diamond, were described as having been found in a meteoric iron from Western Australia. "If this supplementary discovery be confirmed," says *Nature*, "we may at last be placed on the track of the artificial production of precious stones."

A Precious Stone of much interest has been discovered in Colorado. It is an opaque white hydrophane. The finder calls it "magic stone," because, as usual with this mineral, it has the property of becoming transparent if water is dropped slowly on it from one to three minutes. It is so porous, that it will absorb its own weight in water. It quickly recovers its opacity.

Compounds of Alcohol with Water. — Mendeljeff has, by a study of specific gravities of mixtures of alcohol and water, arrived at the conclusion that there are three definite hydrates, containing respectively three and twelve molecules of water to one molecule of alcohol, and three of alcohol to one of water. The first of these has been obtained in the crystalline form at the temperature attained by a mixture of solid carbon dioxide and ether; the second solidifies at −17°.

Newspaper Science. — An English daily paper recently published the following novel information regarding the lunar eclipse of Jan. 28: "A solar eclipse only lasts a few minutes, owing to the fact that the shadow of our earth is so much smaller than the sun; but in the case of a lunar eclipse, our earth's shadow is much larger than the body of our satellite, and consequently her passage through the shadow, from side to side completely, occupies several hours."

An Interesting Spider. — The habits of a running spider of Southern Europe, *Tarantula narbonensis*, Latr., studied by Herr Beck, are curious. It makes a vertical round hole in the ground about ten inches deep, and this, with a small earth-wall sometimes made round the mouth, is lined with web. A little way down is a small lateral hole into which the spider shrinks when an animal falls into the tube; when the animal has reached the bottom, the spider pounces on it. One can readily tell that a tube is tenanted by the bright phosphorescent eyes of the spider turned upwards. In fighting the spider erects himself on its last pair of legs, striking with the others. The bite is not fatal to man, but it causes large swellings. The children in Bucharest angle for these spiders by means of an egg-like ball of kneaded yellow wax tied to a thread. This is lowered with jerks into the hole, and the spider fastens on it, and can be pulled out; whereupon another thread is passed round one of the legs, and the animal is played with.

Practical Chemistry and the Arts.

PLATINUM.

When the early Spanish explorers found in the alluvial deposits of South America grains of a hard white metal heretofore unknown to them, they considered it to be an inferior kind of silver, and gave to it the name *platina*, a diminutive of the Spanish word for silver, *plata*. It was not thoroughly studied until 1752, when Scheffer, the director of the Swedish mint, published a full account of the new metal. Since that time its applications in the arts have been constantly increasing, but its use is greatly restricted by its scarcity and consequent high price.

Platinum is always found native, or in the metallic state, but is usually alloyed more or less with iridium, osmium, and other metals of the so-called platinum group, as well as iron and the more common ones. The annual product of platinum is between two and three tons, of which the United States furnish about two hundred ounces. When separated from its impurities, and worked into scientific apparatus, it is worth from ten to fifteen dollars an ounce; but since the general introduction of electric lighting, such a demand for platinum wire has arisen, that the price is constantly tending upward.

Platinum is one of the heaviest metals known, its specific gravity (21.5) being only slightly exceeded by iridium and osmium. It is only fusible in the heat of the oxyhydrogen flame at a temperature of 1480°, and will dissolve only in nitro-hydrochloric acid. This refractory nature renders it very suitable for crucibles, dishes, and other apparatus used by chemists. Large retorts of platinum are used in the manufacture of sulphuric acid, for concentrating the weak acid by evaporation. A retort capable of concentrating eight tons of acid daily, costs over eight thousand dollars. In the year 1828 the Russian government commenced coining the metal, but discontinued it in 1845. It is also very largely used, as stated above, in the manufacture of incandescent electric lamps.

Platinum is extensively used in dentistry in the form of rivets for fastening artificial teeth to the rubber or celluloid plate. After the teeth are worn out, the rivets are bought by dealers in platinum scraps, and worked over again. Certain mysterious and suggestive advertisements for second-hand sets of teeth which occasionally appear in the newspapers are thus susceptible of a simple and reassuring explanation.

Formerly platinum was obtained from its ores by a tedious process of dissolving in acid, and precipitating the metal in a finely divided condition known as platinum black, which was consolidated by pressure into a form suitable for working. The more usual process is by smelting with lead ore, which removes most of the impurities. The lead is afterwards removed by cupellation, and the platinum re-melted in a limestone crucible by the oxyhydrogen blowpipe, to further purify it. In 1862 a firm of platinum-workers exhibited in London an ingot of pure platinum weighing two hundred and fifty pounds, and valued at twenty thousand dollars.

Platinum is extremely ductile, and can be drawn out in a wire thinner than a spider's web. This is accomplished by covering a fine platinum wire with silver, and drawing the whole out together, after which the silver is removed by dissolving in nitric acid.

Platinum when in a finely divided condition possesses the remarkable property of absorbing and condensing large quantities of gases, especially oxygen. If a jet of hydrogen or illuminating gas is directed upon a small mass of spongy platinum or platinum black, the gas combines with the oxygen absorbed in the metal; and this combination is attended with so much heat, that the platinum becomes red-hot, and finally causes the ignition of the gas-jet. This experiment can also be performed with a piece of platinum wire or foil, if it is first heated to redness, and placed in the gas-jet before it becomes quite cold.

Notwithstanding its highly refractory nature, apparatus made of platinum must be handled with considerable care. Although platinum by itself is very infusible, it easily unites with other metals at a low temperature, forming readily fusible alloys. Many an expensive crucible has been ruined through the inexperienced or careless experimenter attempting to ignite a salt of lead or zinc in it. Phosphorus, sulphur, and caustic potash also attack it, and even certain parts of the flame of a Bunsen burner will disintegrate it in time. Solutions which give off chlorine gas must also be kept away from platinum dishes, and of course nitric and hydrochloric acids must never be mixed together in them. Platinum vessels will last much longer if always kept bright and clean. Gentle rubbing with sea sand gives a fine polish; or, if the interior is very dirty, borax or bisulphate of potash may be fused in them.

Very little platinum apparatus is produced in this country. As far as we know, a factory at Sugartown, Penn., is the only one in the United States. A few firms in London and Paris manufacture a large proportion of the platinum used in the arts; but the American product is fully equal, in point of finish and durability, to that made in Europe.

PREPARATION OF PEROXIDE OF HYDROGEN ON A LARGE SCALE.

Which particular process is used by the different makers of peroxide of hydrogen is not known to us; but it is evident that the largest manufacturers of this article, who turn out many thousand pounds a week, cannot employ the usual methods quoted in chemical text-books. On glancing over the literature of the subject, we find that Duprey's process appears to have the best chance of being employed on a large scale, at least among those which have been published. The process is as follows:—

A rapid stream of carbonic-acid gas is conducted through cold water, and to it are gradually added small portions of peroxide of barium reduced to an impalpable powder. According to Otto, it is preferable to use the hydrated peroxide of barium, which is obtained as follows: Finely powdered peroxide (dioxide) of barium, or the commercial so-called hydrated peroxide, is added to dilute hydrochloric acid until the latter in nearly saturated. The solution is filtered and cooled, and then mixed with just enough solution of baryta to precipitate the foreign oxides and silica, and to produce a small precipitate of hydrated peroxide of barium. It is then again filtered, and, by addition of concentrated solution of baryta, the hydrated peroxide of barium precipitated in a crystalline state. This may be preserved in a moist condition for a long time without spoiling, provided it is kept in air-tight vessels.

The products of the reaction are insoluble carbonate of barium and a solution of hydrogen peroxide. When a considerable amount of the former has been produced, it is allowed to deposit, the clear solution removed, and the process continued as before. The liquid must be kept cold, towards the end, by the application of ice; and care must be taken that there is always an excess of carbonic-acid gas, which should keep the precipitate as it forms in suspension, and prevent it from settling to the bottom. The small amount of barium which remains finally in solution as bicarbonate, may be precipitated by the addition of a few drops of dilute sulphuric acid. A small excess of the latter is an advantage, as it will cause the product to keep better.

The advantage of this method is, that it does not require any filtration, and that it furnishes a perfectly pure product if the hydrated peroxide of barium has been used. A vital condition of success is to add the peroxide in small quantities at a time, and if it is in a dry condition, to have it in the finest possible powder.

The preparation of peroxide of barium on a large scale, for the purpose of employing the product in the manufacture of hydrogen peroxide, is carried on by passing moist atmospheric air, freed from carbonic-acid gas, over anhydrous baryta raised to faint redness in iron retorts.—*Druggists' Circular.*

SCIENTIFIC RAILROAD-BUILDING.

The first train of cars has crossed the long bridge that has been thrown over the Oxus River in Russian Central Asia. This structure, which is nearly a thousand feet longer than the Brooklyn Bridge, including its approaches, spans a classic river, of which very little was known thirty years ago, except through the writings of the old historians, who described the exploits of Alexander and Tamerlane. The man who ten years ago had predicted that to-day iron rails would stretch over wide deserts and the upper course of the famous Oxus, which had been reached in modern times by only three or four disguised white men, would have been looked upon as a visionary enthusiast. The road-bed has been graded for nearly the entire distance between the Oxus and Samarcand; and, with the completion of the bridge, the work of laying the track will rapidly proceed. Within the next three months it is expected that the trans-Caspian railroad will be completed to Samarcand, and trains running from the Caspian Sea to the capital of the great Mongol conqueror. This road is remarkable, not only because it pushes far into inner Asia, but also because some unique problems in railroad construction have been solved by its successful progress. Many engineers said a railroad could not be maintained through the shifting sands of the Kara-Kum desert. But General Aunenkoff, by covering parts of his roadway with clay, by placing in his embankments layers of the branches of a desert shrub, and by cultivating along parts of the route many thousands of desert plants whose roots retain

the sand, has thus far maintained his road-bed without deterioration. The problem of a water-supply was solved by bringing water in pipes from mountains that skirt two hundred miles of the route, also by canals from the Murghab; while artesian wells are the source of supply between Merv and the Oxus. In a region that is destitute of fuel, and where the cold is at times intense, petroleum has been utilized to drive the locomotives and to heat the sixty railroad stations along the way. Russia may indeed be proud of the success, now well assured, of her unique and astonishing experiment in railroad-building. — *New York Sun.*

A SIMPLE THERMOSCOPE.

For a year past there has existed in Berlin a disinfecting establishment, in which all objects that have been in contact with persons suffering from a contagious disease are submitted to the action of superheated steam. The disinfection is not regarded as perfect until the entire mass has reached the elevated temperature of the steam; and in order to make sure that such temperature has been everywhere reached, Herr Merke, the director of the Moabit Hospital, has devised a simple apparatus, which he introduces into the interior of the mass to be treated. It consists of two pieces of wood jointed at the centre, and the ends, *a*, *a*, of which (Fig. 1) are held in contact by a spring, and are provided with pieces of metal, *c*, *c*. The other

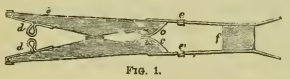

Fig. 1.

Fig 2

ends, *b*, *b*, are provided with three metal eyes, — two on one face, and one on the other. When the ends *b*, *b*, are brought together, they are held in position by passing through the eyes a small pin formed of an alloy fusible at 100° C. (212° F.). When the apparatus is exposed to such a temperature, the pin melts, and the spring *f* brings the metal parts *c*, *c*, in contact. As the wires of a pile are connected with the two metal surfaces at the points *e*, *e'*, a circuit is established as soon as a contact takes place, and thus rings an electric bell. — *La Lumière Electrique.*

ELECTRIC "SUNSTROKE."

That portion of man's inheritance that consists of "ills" seems to be daily increasing. M. Defontaine, doctor-in-chief to the Creusot Steel Works, in a paper read before the French Society of Surgeons, states that workmen employed in operating the electric forges at Creusot are subject to a form of sunstroke which he attributes to the intense light radiated from the focus of the forge. Ordinary arc lamps are incapable of producing such effects, as the light is not sufficiently intense; but these forges emit a light of more than a hundred thousand candles from a few square centimeters of surface, producing on men exposed to their glare physiological consequences previously unheard of. Frequently, after two or three hours' work, the men complain of pains more or less intense in the neck, the face, and the forehead, simultaneously with which the color of the skin is changed to reddish brown. Further, in spite of the precaution taken by the men of shielding their eyes with dark glasses, the retina is affected to such a degree that for some minutes after ceasing work the operatives are totally blind to all objects illumined with common daylight, nor is perfect vision restored till nearly an hour after. The conjunctiva are irritated, and remain in a state of congestion for forty-eight hours; and this is accompanied by a painful feeling, as of some foreign body introduced under the eyelids. The secretion of tears is augmented, a constant flow being kept up for twenty-four hours, during which the patient suffers from insomnia, due to pain and the abnormal flow of tears, and possibly also to fever. During the following days the skin peels off the face and neck, which become of a deep-red color, fading away about the fifth day. In cases of ordinary sunstroke, heat may have some influence; but in those considered above, the whole effect is due solely to the action of an intense light. — *Engineering.*

A MUCH-NEEDED INVENTION.

Notwithstanding the large number of fountain pens, stylographs, and similar writing devices, the majority of which are but vanity and vexation of spirit, nothing has yet supplanted the old-fashioned lead-pencil in efficiency and reliability. It is, however, a great annoyance to constantly stop and fashion a fresh point, with the accompanying search for a penknife, and the disposal of the dust and shavings. The pencil sharpeners in common use make only a point so short and blunt that the sharpening process must be repeated every few minutes What is needed is some device which can be sold at a low price, and which will cut a long, sharp, tapering point, such as at present can only be formed by a penknife in the hands of an expert sharpener. If some such improved form of pencil-sharpener could be properly brought before the public, the inventor would doubtless gain a large fortune as the reward of his ingenuity.

CHEMICAL NOTES.

Separation of Nickel and Cobalt. — M. Baubigny announces that from solutions containing both these metals, he can obtain, by a judicious use of sulphuretted hydrogen, a perfectly pure sulphide of *either* of the above.

Thallium in Platinum. — After having detected thallium in platinum wire and foil by spectral analysis, Mr. H. N. Warren endeavored to separate the metals. Ten grams of the wire were dissolved in nitro-hydrochloric acid, and after evaporation to dryness, and resolution in very dilute nitric acid, hydriodic acid was added, and the thallium precipitated as iodide. The proportions of thallium found varied from 0.02 to 0.1 per cent, the wire containing more than the foil. Alloys of platinum and thallium containing 0.5 per cent of the latter are useless for wire, and 2 per cent thallium gives an alloy fusible at a red heat.

Ozone from Pure Oxygen. — This was the title of a paper lately communicated to the Chemical Society of England by Messrs. W. A. Shenstone and J. Tudor Candall. The authors describe an apparatus in which oxygen has been prepared and stored without the possibility of air gaining admittance. So far as it is possible to determine the purity of the gas by tests, it would appear certain that it has contained at most $\frac{1}{5000}$ of nitrogen. The oxygen has been collected and sealed up in glass tubes containing phosphoric oxide, in contact with which it has been kept for periods ranging from eight weeks to eight months. Subsequently it has been submitted to the action of electricity, and the ozone produced has been measured. In one experiment made at 10° C., no less than 11.7 per cent of the oxygen taken was converted into ozone. This is a considerably higher proportion than has been obtained either by Brodie or by the authors from ordinary oxygen when similar means of electrification are employed, but not so high as was obtained by Andrews and Tait, who, however, worked in a different way, and the exact value of whose results is uncertain, in consequence of the tendency of the sulphuric acid that they used in their gauges to absorb ozone.

PRACTICAL RECIPES.

A New Soldering Fluid. — Take two ounces alcohol and put it into a bottle, and add about a teaspoonful of chloride of zinc, and shake until dissolved.

Mix some finely powdered rice with cold water, so as to form a soft paste. Add boiling water, and finally boil the mixture in a pan for one or two minutes. A strong cement is thus obtained, of a white color, which can be used for many purposes.

Impermeable and Transparent Paper. — A French journal gives the composition of a preparation for waterproofing fabrics, leather, etc., of which the formula is as follows: —

Turpentine paste	6 kilos.
Tallow	1.5 "
Wax	0.5 kilo.
Styrax (necessary, and not optional)	0.2 "

The inventor has since found that a homogeneous substance is obtained. He now proposes to apply this mixture to paper, in order to make it transparent and impermeable to air or moisture.

To Prevent Steel Implements Rusting. — The following is said to be a good application to prevent metals rusting: "Melt one ounce of resin in a gill of linseed oil, and while hot mix with it two quarts of kerosene oil. This can be kept ready to apply at any time with a brush or rag to any tools or implements required to lay by for a time, preventing any rust, and saving much vexation when the tool is to be used again.

To Copy Engravings. — An exchange gives the following method, which may be worth trying; but it should not be used upon engravings of any value, as the original would probably be spoiled: "Place the engraving a few seconds over the vapor of iodine. Dip a slip of white paper in a weak solution of starch, and when dry in a weak solution of oil of vitriol. When again dry, lay a slip upon the engraving, and place both for a few minutes under a press. The engraving will be reproduced in all its delicacy and finish. Lithographs and printed matter cannot be so transferred with equal success."

Black Varnish. — To make a good black varnish for ironwork, take eight pounds of asphaltum and fuse it in an iron kettle, then add two gallons of boiled linseed oil, one pound of litharge, one-half pound of sulphate of zinc (add these slowly, or it will fume over), and boil them for about three hours. Then add one and one-half pounds of dark gum amber, and boil for two hours longer, or until the mass will become quite thick when cool. After this it should be thinned with turpentine to the proper consistency.

Black Coating for Brass Objects. — The above composition is made by dissolving 1.05 ounces carbonate of copper, while being well stirred, in 8.80 ounces of spirits of ammoniac, 17.60 ounces of water being added to the solution. The brass objects should have been well polished with emery paper, and are fastened to brass or copper wires. They are plunged for a short time in the solution, and when completely blackened are rinsed in water. They are then dried in sawdust, and finally rubbed with oil varnish diluted with oil of turpentine. This black coating is said to be durable, and to stand exposure in the open air.

Home, Farm, and Garden.

THE GROWTH AND DECAY OF ROCKS.

The belief that rocks and stones, especially the loose bowlders found in the drift, have grown and are growing in their present situation, is not uncommon among ignorant people. At certain points on the coast of Maine the fishermen are unanimous in their belief that the rocks in the harbors are growing, as they find less water over them than in former years. This is probably true in one sense, as there can be but little doubt that the land in those localities is slowly rising.

The early settlers of New England, in ploughing up their land for the first time, and finding it filled with rounded rocks of every size, from the tiny pebble to the massive bowlder, and knowing nothing of the great ice age and the geological discoveries of more modern times, might well have thought that the stones had grown *in situ* by some concretionary process; but we now know that they are rather diminishing than increasing in size, and that they have all been transported from the parent ledge by the irresistible power of moving ice, in many cases for hundreds of miles.

Nevertheless, it is true that many rocks actually do grow. The limestones have been formed by living organisms, like the coral polypes; and it may even be said of many limestone deposits, that every particle has at some time formed a part of a living animal. Sandstones, slates, and probably some varieties of granite, have all been deposited underneath large bodies of water, and in this sense have gradually grown to their present dimensions. Only the igneous or volcanic rocks cannot strictly be said to have "grown," and those of this class which are highly crystalline may be indirectly so considered, as the formation of a crystal, either from fusion or solution, presents in many ways a wonderful resemblance to the growth of a living organism.

It is, however, the decay of the rocks that is of the most importance, and with which we have most to do. The "eternal hills" are not only often "shaken," but are very far from being eternal. They are constantly decreasing in size, and being washed down into the valleys. Even the lofty Alps are considered to be but the "stubs" or remains of a much loftier range existing in past geological epochs. It is to this constant degradation and decay that the farmer owes his fertile fields, as the soil from which he raises his crops was at one time in the condition of hard and barren rock.

The agencies which cause the decay of the rocks are very numerous and varied. Cold, heat, frost, rain, wind, vegetation, running streams, and standing water all do their part; and chemical decomposition is an important factor, especially with granites and other rocks containing felspar. Extremes of heat and cold cause the surface of the rock to crack, and the cracks become filled with water, which freezes and expands, breaking it up still further. Every stream of water, from the trickling raindrops to the rushing torrent, does its part in wearing away and pulverizing the rocks in its course; and the finely divided material is carried along by them, and deposited along its banks, or in the sea at its mouth. In dry countries the sands of the deserts, blown about by the winds, wear away the rocks, just as, on a smaller scale, the sand-blast cuts the hard glass, and engraves beautiful designs on its surface.

In that wonderful natural laboratory which exists in every growing plant, there are reagents which can slowly but surely act upon the hard, stony particles in the soil, and cause their decomposition. The wheat-stalk, for instance, possesses the power of assimilating from the soil that most refractory element, silica, which the chemist can only dissolve by the aid of his most powerful reagents, and building it into its structure to give it the requisite strength. In a similar way, lime, magnesia, phosphoric acid, and potash are all derived from the soil, causing the further disintegration of the more or less fine grains of sand or rock previously existing there.

The decomposition, or "weathering," of granite and other felspathic minerals is a matter of much interest. Granite is a composite rock formed of the minerals quartz, mica, and felspar. Quartz is one of the hardest and most permanent of minerals; but mica, and more especially felspar, contains alkalies which are easily removed. Chemically speaking, felspar is a silicate of alumina and potash or soda. The chemical combination is so weak, that, under the action of the elements, the potash or soda is rendered soluble and washed away, while the silicate of alumina remains as a fine white powder, known as kaolin or porcelain clay. The large deposits of this valuable substance in various parts of the world are supposed to have been formed in this way by the decomposition or weathering of felspar or felspathic rocks.

We thus see that even in the mineral kingdom there is a constant change. The solid rocks are ground down into gravel, sand, or clay of various degrees of fineness. The streams transport them to the lower levels, or spread them out over the ocean's bed. We know that in the past these deposits have been hardened and consolidated into conglomerates, sandstones, schists, shales, slates, and metamorphic rocks, and raised up by the contracting earth into hills and mountains once more. Whether this process is ever to be repeated, we do not know; but as long as the present natural forces are in operation, we know that the mountains, hills, rocks, and stones are continually decaying, and the surface of the earth tending to one general level.

STABLE MANAGEMENT.

Pure air is as essential to the blood as sound food is to the sustenance of the body. Consumed air is vitiated air, the volume of oxygen is reduced, carbonic acid is in excess. The stable is full of organic impurities given off by the skin and the lungs Ventilation is found in all well-regulated stables, and draughts are unknown, or ought to be. But these are matters for individual consideration, and are best settled by the builder.

Horses drink once or twice a day, and the horse may be trusted to gauge his thirst, except on occasion of extreme exertion, such as a hunting morning. That all horses are the better for being watered before being fed is an admitted fact with all veterinary surgeons and intelligent grooms. Colic and gripes are thus avoided. The explanation given is this: When the stomach is full, water, passing rapidly through the stomach, on the way is very apt to carry with it, into the small intestines, undigested corn, and this produces local irritation. There is less danger in watering a horse actively warm than when the system is somewhat lowered. In the latter case there is not sufficient vitality to raise any considerable quantity of cold water up to the temperature of the body: hence so many chills supervene, bowels are deranged, and the coat of such horses looks unthrifty, or, as we call it, "stares." Soft water is better for all stock, and on no account let horses drink dirty water: it is most objectionable.

Horses have small stomachs. We divide the corn into three daily portions, the hay into two. We never give hay just prior to work: it distends the stomach, and causes the horse inconvenience.

Delicate feeders must be tempted to take their rations, and such should never be fed too strongly at one time. "A Scotch plate" is the rule here, — every thing cleaned up before placing other food in the racks or mangers. A little linseed boiled to a jelly and mixed with the corn is seductive. Hay damped and salted will tempt others. Tick-beans, a double handful, are a relish in weakly subjects, pale malt for the convalescent or indisposed; damp bran and oats are engaging for others. Some grooms give carrots and tares in small quantities. Carrots superinduce diabetes if given in excessive quantities. The peculiar habits of horses demand the attention of all horse-owners and grooms. A sufficiency of flesh is all that is required, and not "hog fat," or "beastly fat" as some phrase it.

The quantity usually given to hunters and thoroughbreds is fourteen to sixteen pounds of oats daily; i e., two and a quarter to two and a half bushels per week. Carriage horses in town, ditto.

Beans should be hard, dry, sweet, plump, sound, not less than a year old, and weigh sixty pounds to the bushel; a double handful each principal meal, morning and night (about two pounds daily), in the fall and winter months. New beans are colicky feed, and less nutritious than old. Peas and beans should always be split, to insure uniform quality.

Horses fed largely on other foods demand less hay, but hay is useful in distending the stomach, and thus assisting digestion. From six to fourteen pounds daily; the average use is ten pounds in many stables To maintain hunting or racing condition, old hay is essential.

Clover, vetches, and trifolium are laxative and cooling, and excellent for the invalid horse or the youngster. They should be given sparingly, at the early part of the season. Green forage should never be given to horses in fast work, except on Saturday nights.

Good grooming is demanded under stable management and in fast work. The brush, as a rule, should follow the direction of the hair, except when dirt and sweat are caked onto the coat: then you require to go against the lie of the coat — the set of the coat. Good grooming shortens the coat, gives a gloss, and develops physical force. When a good gloss is present, we know the effetes

of the body — dirt, stall sweat — have been removed by friction, and that the sweat and oil glands have been stimulated. Of course, warmth shortens a coat, and moderate warmth in a stable, say 60°, is desirable. A hot stable is contrary to all sound practice, and renders bronchial attacks imminent. Horses should always be groomed after exercise, and, if washed, should be thoroughly dried. Washing horses, except as a refresher in very hot weather, is bad: it makes the coat harsh. Of course, mud is usually removed, for the sake of expedition, by water; but, unless well dried after it, grease, cracked heels, mud-fever, etc., are sure to set up.

After washing feet and legs, and drying them, the legs should be neatly bandaged. Nostrils are, of course, sponged out twice a day, the dock likewise. White legs must be treated to soap and water. Good grooming, feeding, and exercise — i.e., stable management — will put any horse into working condition, and keep him there, with the occasional use of an aperient or diuretic ball, as occasion may demand. — R. H. HILHOUSE, *in Agricultural Gazette.*

SELECTED RECIPES.

THE recipes given below were translated from the French and German for the *Practical Confectioner.* They have all been tested, and may be relied upon to produce good results.

CREAM CANAPES. — Cut little rounds of bread, fry them a pale golden color, curl some boned anchovies or sardines round on them, and pour over each either Devonshire or whipped cream.

TOMATO AND SARDINE SANDWICHES. — Bone and pass one dozen sardines through a sieve. Place them in a mortar, and pound with them a piece of butter, Nepaul pepper, white pepper, and salt. Skin six tomatoes; cut them into slices; squeeze lemon-juice over each slice, and sprinkle over just a suspicion of sugar. Place this mixture between little rounds of bread and butter.

SALMON SANDWICHES. — Cut slices of boiled salmon, and place on each slice two thin slices of cucumber. Place them between bread and butter, and roll them up in a lettuce-leaf soaked in vinegar for an hour. Then take them out of the lettuce-leaf, and cut them into shape. Or they can be made with a little salad dressing laid on the cucumber, instead of rolling them in lettuce-leaves.

NEAPOLITAN LEMONADE. — Take two dozen lemons, pare them very thin, and press out all the juice. Pour the juice on the peel, and allow it to remain twelve hours; then add two pounds of loaf sugar, a quart of white wine (sherry), and three quarts of boiling water. Lastly add a quart of boiling milk. Clarify by passing it through a jelly-bag. It is very rich.

VANILLA-CAKE. — Five ounces white almonds are pounded with three eggs, then mixed with five ounces sugar, the yolks of eight eggs, and a little vanilla, and the whole stirred to a foam. To this mass is added the snow of the white of four eggs, two ounces and a half flour and lastly a cup of milk. The mould is lined with puff paste, the above mass poured into it and baked very slowly. Afterwards it is glazed with vanilla glaze.

ANGEL-CAKES. — These cakes are exceedingly light and good, but they must be eaten whilst perfectly fresh. Take the whites of six fresh eggs, and beat them to a froth; then add six ounces of best white powdered sugar and a teaspoonful of vanilla flavoring. Into this stir lightly four ounces and a half of the finest white flour, which must be perfectly dry; in fact, it is much better warmed. Pour at once into a tin (about half filling it), and instantly transfer to an oven with a good regular heat, neither too hot nor too cold. When baked, do not put it in a cold place at once, but let it gradually cool.

KING'S CAKE. — Of three ounces and a drachm and a half of almonds, half a pound of sugar, and some candied lemon-peel, a macaroon paste, not too stiff, is made, and spread on paper and baked. Now make a sheet of almond paste, consisting of three ounces and a drachm and a half of sugar, three ounces and a drachm and a half of almonds, the yolks of six eggs, a lemon, one ounce and nine drachms flour, the snow of the white of four eggs. Pour the mass into a ring, and bake. The sheet of macaroon paste is cut lengthways in two, and orange crême (see below) put between the two halves. On the macaroon bottom a layer of apricot jam is spread, and the two put together. This cake may be glazed with any glaze, and it is surrounded with round macaroons before drying.

To make orange crême, mix the yellow of an orange rasped on sugar, seven ounces and six drachms sugar, and the yellow of twelve eggs; beat this together to a good froth, add the juice of one and a half oranges and the same of one and a half lemons, and one-fifth of a pint of hock. Beat the whole over a slow coal-fire, upwards, like the mass for sponge-cakes. A drachm is one-eighth of an ounce.

ALMOND TART. — One pound of sweet almonds, thirteen ounces of sugar (pounded very finely in a stone mortar), twelve or fourteen eggs, one lemon, the juice of same, some mace, one and five-eighths ounces of potato-flour. When the sugar and almonds are well pounded and mixed, the whole is put into a dish, and well beaten with the whole of nine eggs and the yolk of all the eggs — the white of five eggs is reserved. Then put in the potato-flour, and pass the snow of the reserved whites of five eggs under it. Bake in a pan lined with paper, and, when done, turn it out on a sieve, take the paper away, and cover with powdered sugar from a dredger.

COFFEE CHARLOTTE RUSSE. — Line a mould with ladies'-fingers. Take half a pound of freshly roasted coffee. Boil one quart of cream; put the coffee in it, and let it stand in a warm place for an hour. Put six yolks of eggs in a stewpan, with half a pound of castor sugar. Strain in the coffee cream, and stir over the fire until the eggs begin to thicken. Soak three-quarters of a leaf of gelatine in cold water, drain and add it to the cream, and stir over the fire until the eggs begin to thicken. Soak three-quarters of a leaf of gelatine in cold water, drain and add it to the cream, stir till the gelatine is melted, strain through a tammy into a basin, and stir the cream on ice till it begins to thicken. Add one quart of well-whipped cream, fill the mould, and let it remain in ice for an hour.

CARE OF LAMPS.

WHATEVER about the house is dull, don't let it be the scissors or shears used for trimming the lamp-wicks. Some women appear to attach no importance to this point, not thinking that, in order to have a smooth cut, the instrument must be sharp. I have tried both round and square ends for wicks, and give my vote in favor of square ones: the flame is much broader. But the corners must be perfectly even and smooth, else, when the wick is turned up high, it will smoke. The person lighting a lamp should be careful not to touch the wick with the match, as it has a tendency to roughen or spread it. Hold the match over the wick very close to it, and wait until the flame reaches it, instead of making frantic dashes at it, as I have seen people do, evidently under the impression that they were hastening the operation, when it seemed to me they were, on the contrry, retarding it, as they would draw the match away before the wick had time to ignite, and so several trials would have to be made. I have had so much comfort from following a simple direction given in some newspaper or magazine, that I wish to allude to it here; viz., Keep the wick turned down below the top of the burner, except when in actual use. If this be done, and there is no leak about the fixture, there is no reason why, if the lamps are carefully wiped every morning, there should be oil on the outside by evening. By the way, why is it that so many housekeepers persist in keeping their common lamps on the shelf behind the kitchen or sitting-room stove, the very dirtiest place to be found? If in the kitchen, they are covered with moisture from boiling water, etc., and smoke and dust arising from the stove. Why not put them in a closet, or, if that is not convenient, have a shelf away from the stove? If kept in a cold closet in the winter, of course they should be taken out and warmed before being lighted, lest the chimneys should crack.— *Good Housekeeping.*

GLEANINGS.

AIR-SLACKED LIME proves, according to Mr. J. Miles, to be an effective remedy for the turnip, cabbage, and onion maggots. It should be used freely, and worked well into the soil close to the plants.

FOR MOSQUITO or gnat bites an experienced traveller writes that he uses a solution of alum-water as strong as it can be made, adding one-fourth of aromatic vinegar and one-fifth of glycerine. Shake well before using. It will instantly cure the bite

MUSHROOMS. — It is a favorite theory with some that the nutritive value of many of the fungi that are used as food is almost equal to the nutritive value of meat. A recent statement by the eminent chemist of Germany, Mr. C. T. Morner, is to the effect that the total nitrogen in this class of fungi varies between 2 and 3.64 per cent in the dry material; that 41 per cent of the total nitrogen is useful in alimentation; that all the rest belongs to non-assimilable bodies; and that, notwithstanding the relatively high figures, fungi constitute a very mediocre food, since the figures relate to dry material, and fungi contain enormous quantities of water. Mr. Morner, in this connection, gives a number of tables which show the amount of the several fungi that would be required to equal a pound of beef — mushrooms, nine pounds; *Lactarius deliciosus*, twenty-four pounds; chanterelle, forty-one pounds; morel, fifteen pounds; *Polyporus ovinus*, sixty-seven pounds.

DANISH BUTTER-MAKING. — Professor Robertson calls attention to what he describes as a common practice in Danish butter-making. In order to ripen the cream quickly for churning, he says, Danish dairy farmers prepare what is called a "fermentation starter." As much milk as will yield two per cent of the whole to be churned each day is set in the evening, and skimmed the next morning. The cream so obtained is warmed to seventy-two degrees Fahrenheit, and placed under cover, so as to retain its heat. By the following morning it has become sour, and is fit for use as a "fermentation starter." After the bulk of the cream has been separated by the centrifugal machine, it is heated to seventy-two degrees, and placed in tin-lined cream-tubs, two per cent of the "fermentation starter" being added. The whole is allowed to cool down to fifty-eight degrees, and, after about eighteen hours, it is considered in the right condition for churning. The temperature at which the cream is churned varies from fifty-seven to sixty-four degrees.

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AUSTIN P. NICHOLS, S.B. . . . . *Editor*
WILLIAM J. ROLFE, LITT.D. . . . . *Associate Editor*

ALLOYS, formed by melting two or more metals together, present some very interesting characteristics. One of the most curious is the fact that the melting-point of the alloy is usually much lower than that of any of its components. Wood's alloy, for instance, which consists of lead, tin, cadmium, and bismuth, melts at about 150° F.; while the lowest melting-point of any of the metals separately is that of tin, 446°. It has always been supposed that this alloy could only be formed at a comparatively high temperature; but Mr. William Hallock has recently shown that when the several metals are mixed together in filings, and exposed for twenty-four hours to the heat of an ordinary water-bath (212°), the alloy is produced, and the mass becomes fluid, and that the previous fusion of either constituent is unnecessary. This fact is of the highest scientific importance, and it is rather remarkable that it has never been observed before.

PROFESSOR J. P. COOKE and Mr. T. W. Richards of Harvard College have published some of the results obtained by them in their redetermination of the atomic weight of oxygen, or, more strictly speaking, the ratio between the weights of equal volumes of hydrogen and oxygen. The method adopted was to pass a known weight of hydrogen over heated copper oxide, and to weigh the amount of water formed. The operations were conducted under the strictest conditions, and with the use of every possible precaution; and the ratio finally obtained was 15.953, which Professor Cooke considers as nearly correct as the conditions under which such work must be carried on will allow. In England Lord Rayleigh, by a method of direct weighing, obtained the number 15.912. There are, however, so many sources of error to be allowed for in the latter process, that we are inclined to consider the number obtained by the American chemists as more nearly correct. The correct determination of this atomic weight is not only important as affecting indirectly the atomic weights of other elements, but as regards its bearing on Prout's hypothesis, which holds that the atomic weights are all whole numbers, or simple multiples of the weight of hydrogen, — a theory, it will be noticed, not very well sustained by the results given above.

"A SUBSCRIBER" takes exception to the term "agnostic belief," as applied to the religious opinions of Darwin, in an editorial of the March number. We are willing to admit that the phrase "agnostic belief" is perhaps a contradiction of terms, as agnosticism is rather a non-belief than a belief; but we have Darwin's own words in support of the opinion we expressed as to his position in that respect. In a letter written to a correspondent on the subject, he says: "As far as regards myself, I do not believe that there has ever taken place any [supernatural] revelation. But regarding a future life, everybody has to decide for himself between contradicting, uncertain probabilities." This statement, it seems to us, fixes his position upon theological points, without in any way reflecting upon his moral or intellectual sensibility.

A SHORT article recently copied from an exchange, reflecting upon the intelligence of horses, has stirred up considerable excitement among our readers, and we have been overwhelmed with letters giving instances of the soundest kind of "horse sense." Although we must confess that at the time we were inclined to agree with the disparager of the equine race, we are now somewhat in doubt as to whether the most sensible horses are not equal to the most stupid members of humanity. We at one time owned a horse which practised a regular "confidence game" by pretending to eat his breakfast out of an empty manger, so that he could gain a few moments' delay before being harnessed for the morning's work. This brilliant idea was certainly closely allied to the reasoning faculty, and worthy of an animal much higher in the intellectual scale.

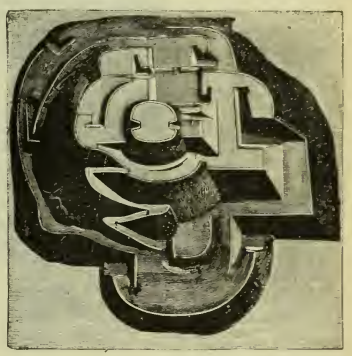
WE doubt very much, also, if any horse, or even his illegitimate descendant, who, as Dr. Holmes remarks, "has no pride of ancestry nor hope of posterity," could have been guilty of such an absurdity as was recently perpetrated by the Iowa Legislature. It seems that many Western farmers have been swindled by parties who sold them worthless seed at a high price, under the name of "Bohemian oats." The irate farmers, following a rapidly growing fashion, appealed to the Legislature for protection against these very bad men; and the wise men of the West promptly responded by passing a law which makes it a penal offence for any one to buy any cereal at more than four times the regular market price for the same kind of grain. The extreme penalty is three years in the penitentiary. It has always been a favorite occupation of legislatures to make men moral by laws, but this is the first instance we have noticed of an attempt to confer common sense by the same agency.

THE patent system of this country is at present in a very unsatisfactory condition, as it neither protects the inventor against infringement, nor the buyer of patented articles against annoying and expensive lawsuits. The history of the Bell telephone is a notable instance of the constant fight which every owner of a valuable patent must make against infringers and "prior inventors" on every hand. Two methods of relief have been suggested; one is, that a patent shall be granted to every applicant, leaving the courts to decide upon its validity. The opposite plan, which we are inclined to favor, would make the officials of the Patent Office the sole judges of the originality of the invention, and only issue patents after a most thorough investigation. Once issued, a patent should be incontestable. This plan would amply protect the rights of inventors, and do away with the innumerable minor patents, which are of no real value whatever, and only serve as a basis for annoying lawsuits and petty blackmailing. Under such a system, it is doubtful if a patent would be issued for the right to tie a knot in a thread, as was done not many years ago.

AN ANCIENT JAPANESE FORT.

WE copy from *La Nature* the plan of an ancient Japanese fort, or citadel, as shown by a model cast in bronze which is in a European collection of Japanese curiosities. The remains of similar structures still exist in many Japanese cities, of which, like the Greek Acropolis, the *siro*, as it is called in the native tongue, was the beginning or nucleus.

An examination of the engraving will show the ingenuity with which the central and highest part is guarded against a sudden attack by the numerous turns and angles in the paths leading up to it, and the ease with which a large force could sally out from its walls to make an attack upon a besieging army.



The general plan of the fort recalls to mind the towers represented on old Assyrian tablets, where the high central tower is approached by an external spiral path; but there is little possibility of the two nations having been in communication with each other.

It is to be noted that the model represented is on a greatly reduced scale. In times of peace the lower terraces of the citadel were probably covered with houses and gardens guarded by the central *siro*. It was, in fact, at such times rather a fortified city than a military fort.

The walls were strongly constructed of immense blocks of stones. Some have been discovered at Osaka, nearly thirty feet in length. The ancient Japanese, like the Egyptians, seemed to have but little trouble in handling, with their rude contrivances, blocks of stone of a size which would tax the power and skill of modern workmen.

Although a fort of this kind could stand but a few hours before modern artillery, it must

have been a very strong defence against an army equipped only with spears or bows and arrows. Under such circumstances it would seem as if it could only be taken by force of numbers, and these ancient structures have doubtless been the scene of many terrible conflicts.

RECENT FEATS IN PHOTOGRAPHY.

The total eclipse of the moon last January suggested to MM. Dumont and Bergeret of Nancy, France, the happy idea of registering the different phases by means of direct photography. The engraving (Fig. 1) is a copy of the photograph thus obtained. The successive exposures were four seconds in length, separated by intervals of five minutes. The gradual increase of the total phase as the image of the moon moved over the plate, is beautifully shown, and those who enjoyed a view of the eclipse can testify as to the accuracy of the photograph.

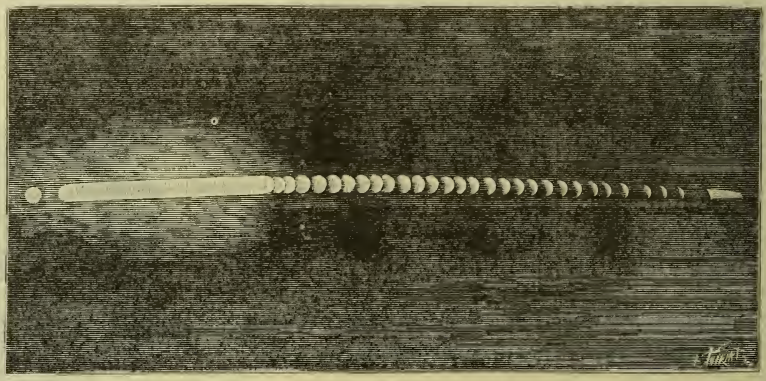


Fig. 1.

The first successful instantaneous photographs of moving men and animals were, we believe, taken by Mr. Muybridge of San Francisco. The two accompanying engravings are from photographs of a leaping horse and rider, taken by a photographer of Brussels. The position in Fig. 2 is somewhat similar to the conventional attitude in which artists are accustomed to paint figures of leaping horses, but a glance at Fig. 3 will show

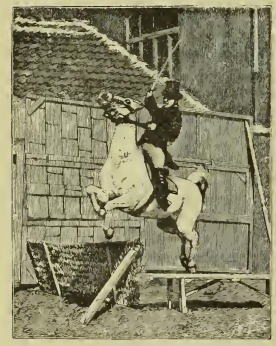


Fig. 2.

how different the actual position really is. It is evident that no horse could remain in such a position for any appreciable length of time; and as the eye requires about a sixteenth of a second to perceive any object, it is not able to note all the different positions taken by the quickly moving horse, which the photographic plate notes and records almost instantaneously.

Pictures like these, which are taken in an inappreciable fraction of a second, are a striking proof of the advance of the science from the time when Dr. Draper considered it a triumph of art to obtain a dim image of a neighboring chimney upon a daguerrotype plate after an exposure of *twenty minutes*.

The engravings illustrating this article are reproduced from *La Nature*.

[Special correspondence of the *Popular Science News*.]

PARIS LETTER.

The topic of the day in biological circles is the result of the recent experiments of Professor Brown-Séquard and his assistant Mr. D'Arsonval concerning the toxic properties of the air expired by healthy men or animals. The experiment is made in the following manner: An animal or man is made to expire in a tube which leads into a glass reservoir; both are surrounded with cold water and ice, so that the condensation of pulmonary vapors is immediately effected. If the process is continued for some time, a sufficient quantity of water is obtained, which may be used for experiments. Another method consists in filling a lung with water, and then emptying it, and using the water. There seem to be very toxic properties belonging to the liquid so obtained; if it is subcutaneously injected in different animals (dogs, rabbits, etc.), death generally is the consequence at the end of a short period, unless the dose is a weak one. In this last case (dose of four or six grams of water) there are curious symptoms to be observed, — the pupils dilate, the breath is much slower, the temperature falls (sometimes five Centigrade degrees), and a general paralysis supervenes, especially in the posterior limbs. The next day the heart seems to be affected, and becomes quite rapid. Death is generally, after a few days (sometimes a few hours with high doses), the consequence of the experiments. The fact is all the more interesting since it has been recently demonstrated that the air expired, even by persons or animals with tuberculous lungs, never contains any bacteria. So bacteria cannot be the cause of the toxic properties of expired air, inasmuch as the water obtained by either of the methods described is always passed through filters, to prevent the presence of all organic bodies; and it must be concluded that the lungs are the seat of some special secretion (gaseous or aeriform, of course), and that the products of this secretion (some leucomaine or other animal alkaloid) are endowed with highly toxic powers.

While speaking of bacteria and allied subjects, I must say a word of the results of Pasteur's recent experiments upon his proposed method of destroying rabbits in Australia. The facts are well known: The Australian government, much frightened by the considerable damage caused by the wild rabbits in agricultural districts, where they have increased of late in enormous proportions, has offered a considerable sum of money to induce researches towards the discovery of some method of destruction of the unfortunate animals. M. Pasteur, on hearing of the matter, remembered having observed the destructive effect upon rabbits of one of the numerous bacteria, studied by himself, — the bacteria of fowl-cholera. He accordingly repeated his previous experiments, feeding rabbits with grass which had been moistened with fowl-cholera cultures, and saw that the effects were very rapid and fatal. At this time he received a letter from a lady whose name is connected with one of the best brands of champagne, Mme. Pommery of Reims, who informed him, that, if he cared to try an experiment upon a large scale, she could enable him to do so. She owned a large park entirely closed with walls, in which rabbits had become exceedingly numerous, — too much for her personal comfort, — and she was quite willing to give M. Pasteur a chance. He seized upon it immediately, and sent one of his assistants with fowl-

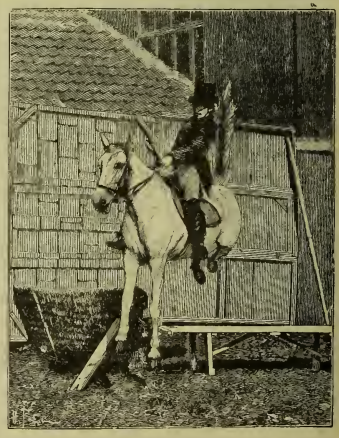


Fig. 3.

cholera culture to Reims. The grass around the rabbits' holes was watered with the culture, and the results were splendid. Rabbits were found dead on the ground and in their holes, in quantities. It seems, then, that M. Pasteur's method is a really

efficacious one. I do not know whether the Australian government intends to avail itself of the opportunity. There is one fact that must be ascertained before applying the method, however: it must be known whether it would not render life absolutely impossible to poultry, or even other animals, in Australia. The question is not one which may be answered *a priori*, and new experiments on a large scale should be made, not in France, however; rabbits being nowhere too abundant, according to the hunter's estimations. But perhaps the experiment might be tried in Australia, with the necessary precautions to prevent general contamination. Bacteria are dangerous creatures, and must not be let loose before the extent of their power has been carefully ascertained.

The *Conseil de Salubrité* of Paris has recently discovered the inconvenience of allowing carpets to be brushed and beaten in the open air in the vicinity of inhabited houses, on account of the dust which is so raised, and especially on account of the bacteria which may be set free when the carpets come from houses where zymotic diseases have existed. The *Conseil de Salubrité* has decided that this operation will be allowed only under the following conditions: The carpets must be brushed and beaten in entirely shut-up rooms, and the dust deposited on the floor will be washed with water containing some disinfectant of potent action; strips of wool, etc., will be burnt immediately. This measure is a good one, and will certainly prove useful. Sources of contamination are much too numerous to be allowed to remain, when we possess means of destroying them.

In the same meeting of the *Conseil de Salubrité* the question of separate barracks for contagious diseases has been much discussed, and it is a shame to the Paris hospitals that more has not been done in this direction. Contagious and non-contagious cases are mixed together in the wards; and it often happens that patients die of a disease contracted in the hospital, after having been nearly cured of that which had caused them to apply for medical treatment. I have myself often seen cases of diphtheria contagion brought on in this manner. The first path in this direction was made some years ago, with good results, when the *accouchement* wards were entirely separated from the surgical and medical ones. Now, each hospital ought to contain a number of entirely separate and distinct wards, one for each sort of contagious disease, or else special barracks must be built for the same purpose. At all events, it is not possible to continue mixing contagious and non-contagious diseases, and having cases of death due to this stupid mismanagement. There are cases, and this is one, in which stupidity becomes criminal.

H.

Paris, *Feb.* 21, 1888.

[Specially reported for the *Popular Science News.*]

METEOROLOGY FOR FEBRUARY, 1888, WITH REVIEW OF THE WINTER.

TEMPERATURE.

Average Thermometer.	Lowest.	Highest.	Range.
At 7 A.M.	22.17°	−3°	44°	47°
At 2 P.M.	32.00°	12°	49°	37°
At 9 P.M.	26.79°	2°	47°	45°
Whole month	26.99°	−3°	49°	52°
Last eighteen Februarys,	25.68°	17.81°, in 1885.	31.38°, in 1877.	13.57°
Winter of 1887-88	24.87°	−8°	59°	67°
Last eighteen winters	25.75°	21.85°, in'74-75.	31.68°, in'79-80.	9.83°

The 10th was the coldest day of the month, with an average of 6⅔°; and the 20th the warmest, at 42½°. The lowest point reached was −3°, on the 16th, and the highest 49°, on the 14th. The mercury went below zero only twice during the month; and the cold waves were brief, not extending over two or three days, occurring chiefly near the 10th, 16th, and 28th. The entire month was 1.31° above the average of eighteen Februarys. The evenings were a near average of the whole month, giving a second average of 26.94°. The most sudden change of temperature was on the 15th, when the mercury went down 35° in 14 hours.

The temperature of the last winter, with the average of the last eighteen, the extremes and ranges, are shown in the table above.

SKY.

The face of the sky the past month in 87 observations (it being leap-year) gave 51 fair, 10 cloudy, 16 overcast, 3 rainy, and 7 snowy, — a percentage of 58.6 fair. The average fair the last eighteen Februarys has been 57.7, with extremes of 30 per cent, in 1884, and 73.4, in 1877. By combining the observations the last month, we find 17 of the 29 days were *fair*. We had two periods, of three days each, very fine, commencing on the 12th and 22d.

The face of the sky the past winter averaged 53.6 per cent fair, while the last eighteen winters have averaged 54.3, with extremes of 38.1 in 1883-84, and 67 in 1877-78.

PRECIPITATION.

The amount of precipitation the past month, including 7½ inches of snow melted, was 5 12 inches. The average for the last twenty Februarys has been 4.98, with extremes of only .55 inch, in 1877, and 11.72, in 1886. The sleighing continued good till the 20th, when a rainfall of 2.28 inches and a temperature of 47° removed almost every vestige of snow.

The amount of precipitation the past winter, including 26½ inches of snow melted, was 15.81 inches; while the average for the last twenty winters has been only 13.47 inches, with extremes of 6 83, in 1876-77, and 22.52, 1885-86. Good sleighing was enjoyed from about Jan. 10 to Feb. 20, — forty continuous days.

PRESSURE.

The average pressure the past month was 30.022 inches, with extremes of 29.51, on the 8th, and 30.34 on the 16th, — a range of .83 inch. The average the last fifteen Februarys has been 29.966, with extremes of 29.834, in 1885, and 30.138, in 1876. The sum of daily variations the last month was 6.94 inches, giving an average daily movement of .239 inch. This average the last fifteen Februarys has been .293, with extremes of .162, in 1877, and .418, in 1887. The largest daily movements were .59, on the 9th, .47, on the 8th, and .46, on the 4th and 25th. The barometric waves were short but frequent.

The average pressure the past winter was 30.023 inches, — a very high pressure. The average of the last fourteen winters has been 29.959.

WINDS.

The direction of the wind in 87 observations gave 18 N., 1 S., 4 E., 19 W., 2 N.E., 30 N.W., 2 S.E., and 11 S.W., — an excess of 36 northerly and 52 westerly over the southerly and easterly, and indicating the average direction to have been W. 34° 42′ N., or N.W. by N. The westerly winds in the last nineteen Februarys have uniformly prevailed over the easterly by an average of 44 05 observations, and the northerly over the southerly, with a single exception, by an average of 22.84; indicating the approximate general average of February to be W. 27° 24′ N. The relative progressive distance travelled by the wind the past month was 63.25 units, and during the last nineteen Februarys 942 8 such units, — an average of 44.36; showing far less opposing winds than usual.

The average direction of the wind the past winter was W. 42° 21′ N., while the average direction for the last eighteen winters has been only W 22° 26′ N.; showing the winds the past winter to have been nearly 20° more northerly than usual.

D. W.

Natick, *March* 5, 1888.

[Specially reported for the *Popular Science News* from the Observatory of the College of New Jersey.]

ASTRONOMICAL PHENOMENA FOR APRIL, 1888.

The Planets.—Mercury and Venus are both morning stars, near each other, but rise only a short time before sunrise, so that they can be seen only in strong twilight. The two planets are in conjunction on April 13, Mercury then being about 1° south of Venus; but it is doubtful whether they can be seen, so near the Sun. Mars comes to opposition with the Sun on April 10, and is then on the meridian about midnight. It is in the constellation Virgo, about 4° north of its brightest star, Spica. During the month it moves about 10° from east to west. The present opposition is rather an unfavorable one, as Mars is not far from Aphelion, and its distance from the earth is consequently much greater than it is when it comes to opposition and perihelion at the same time. The next favorable opposition will occur in 1892. Jupiter is on the meridian about 3*h.* 30*m.* A.M. on April 1, and at about 1*h.* 30*m.* on April 30. It rises about five hours before passing the meridian. It is in the constellation Scorpius, about 6° north of the first-magnitude star Antares (*Alpha* Scorpii), and is east of and moving towards the second-magnitude star *Beta* Scorpii, the distance varying from 5° to 2° 30′ during the month. Saturn is in quadrature on April 18, and is in the western sky in the eveniug. It is in the constellation Cancer, a little east of the prolongation of the line between Castor and Pollux, at a distance from the nearest star equal to about twice their distance apart. Uranus comes to opposition with the Sun on the morning of April 4. It is in the constellation Virgo, west and north of Spica. At the end of the month it is near Mars, a little to the west. Neptune is south of the Pleiades, and sets soon after the Sun.

The Constellations. — The positions given hold good for latitudes not many degrees different from 40° north, and for 10 P.M. on April 1, 9 P.M. April 15, and 8 P.M. April 30. Leo Minor, a small constellation with no very bright stars, is in the zenith. Leo is just south of it, the principal group, the sickle having just passed the meridian. Hydra is below Leo. Virgo, with Mars and Uranus, is in the south-east, about halfway from horizon to zenith. Libra is just rising below Virgo. Going from the zenith toward the east we see first Coma, Berenices, and Canes Venatici; below these, Bootes, then Corona Borealis. Hercules has just risen a little north of the east point. Lyra and Cygnus are on the horizon just north of Hercules. Draco and Ursa Minor are east of the pole star. Ursa Major lies between the zenith and pole star, the pointers being very near the meridian. Cassiopeia is below and a little west of the pole star, and Perseus is west of the latter, at about the same altitude. Auriga is a little higher and farther west. Taurus is on the north-west horizon; above it follow Gemini and Cancer, with Saturn, just west of Leo. Orion is setting in the west, and Canis Major in the south-west. Canis Minor is above and between the last two.

M.

Princeton, *March* 2, 1888.

Correspondence.

Brief communications upon subjects of scientific interest will be welcomed from any quarter. The editors do not necessarily indorse all views and statements presented by their correspondents.

WHERE DID THEY COME FROM?

I notice in the February number an article by J. A. M., in reference to seeing vast numbers of small brown frogs covering the road and vicinity after a slight shower, with the above query. It might naturally be inferred that they probably fell from the clouds with the shower. My observation leads me to a different conclusion. In the summer of 1880, after a copious shower in this vicinity, my colleague Dr. S. told me he noticed, in passing along after the rain, for some distance on the road and over the ground, great numbers of small toads or frogs, which he, as well as others, supposed had fallen with the rain. Having occasion the next morning to pass over the same ground, I found them still there, as represented. My curiosity was excited; I concluded to investigate. I found their presence was confined to a limited locality for a distance of about eight hundred yards or less along the road. In looking about, I discovered several depressions or flat hollows in an adjoining field, from which there were no outlets for drainage, and consequently formed shallow ponds a few inches in depth, and which existed there during the spring and summer, forming a favorable breeding-place for toads and frogs, and where they remained during the time the surrounding ground was in a dry state. After the ground and grass were wetted by the shower, they commenced their migrations, and produced the phenomenon as above. Probably J. A. M. might have solved his question by a little investigation of the ground in the vicinity where he found them so numerous after a shower.

Benj. Frantz, M.D.

Waynesborough, Penn., *Feb.* 21.

A CURIOUS ELECTRICAL PHENOMENON.

Editors Popular Science News:

"There is nothing new under the sun," says the wise man. But when I tell you that I was shocked by a cooking-stove, I think you will agree with me that Solomon's saying did not apply to the case of electrical phenomena. On the afternoon of March 5 I had occasion to be around the stove, which, by the way, is heated with natural gas; I was about to remove a bake-pan therefrom, when suddenly — in fact, as quick as lightning — I perceived that "virtue had gone out of me" in the shape of electricity. In my surprise, I jerked my hand away quickly. Again I tried to remove the pan, and met with a like experience. My curiosity having by this time overcome my surprise, I determined on a further investigation, and found that, no matter what part of the stove my fingers happened to touch, the electricity was drawn forth from them in thread-like streams of blue electrical fire.

A friend was present with me, and witnessed the phenomenon; and, repeating the experiments, I found that no apparent effect followed when her fingers were brought into contact with the range.

H. S. Goodwin.

East Liverpool, Ohio, *March* 5, 1888.

QUESTIONS AND ANSWERS.

Letters of inquiry should enclose a two-cent stamp, as well as the name and address of the writer, which will not be published.

Questions regarding the treatment of diseases cannot be answered in this column.

E. C. M., *St. Paul.* — Is it possible to hold the hand in molten copper without injury, as often stated?

Answer. — Under favorable conditions this is quite possible, as the moisture of the hand is changed into a protecting layer of steam, which keeps the hot metal from touching it. The hand is, as it were, in the spheroidal state, such as may be observed in a drop of water spilled on a very hot stove. It is, however, a very foolish and dangerous experiment for any one to try; for, if the conditions were not perfectly favorable, the loss of the hand would be the inevitable result.

D. S. M., *Watertown.* — It is considered by evolutionists that the brilliant colors of flowers and fruits have been developed by a process of natural selection. The brightest-colored fruits would be most attractive to birds and other animals, and thus their seeds would be eaten and widely scattered, after passing through the body of the animal.

T. B. T., *Vermont.* — What is the principle of action of the so-called "safety-matches," which light only on a specially prepared surface?

Answer. — These matches are tipped with a composition (largely chlorate of potash) which ignites readily on being brought in contact with phosphorus. The phosphorus is contained in the surface upon which they are rubbed, but is an allotropic form of the element, known as red or amorphous phosphorus, which is chemically the same as common phosphorus, but is unaltered in the air, and will only ignite at a temperature of 490° F.

C. L. G., *Boston* — Why does blue clothing take white in photographs, and red, black?

Answer. — Blue light is accompanied by a large proportion of actinic or chemical rays, which act on the sensitive photographic film, and cause it to appear nearly white in the picture. Red light, on the contrary, is almost entirely free from such rays, and has no action on the film, producing the same effect in the picture as a black surface.

J. W. S., *Iowa.* — What is the philosophy of the "popping" of corn?

Answer. — It is caused by the expansion by heat of the air and moisture in the interior of the kernel. The outer covering of the corn is practically air-tight, and the force exerted by the expanding gases finally causes it to burst open; while the starch, of which the grain is principally composed, is puffed up by the explosion into the familiar soft, spongy mass. Probably a part of the starch is converted by the heat into a gummy substance known as dextrine, which gives it consistency and flavor.

R. K., *Conn.* — The substance of which wasps' nests are composed is a true paper, although a very coarse kind. The fibre is gathered by the wise little insects from old logs, fence-rails, dead limbs, etc., and worked into material suitable for nest-building. The wasps were evidently the originators of the modern "wood-pulp" industry.

Observer, *Marblehead.* — During the recent total eclipse of the moon, the light was not entirely extinguished, but the disk was apparently of a red copper color. What is the cause of this appearance?

Answer. — As our correspondent doubtless knows, the moon is eclipsed when the earth passes between it and the sun, thus cutting off the light with which our satellite is usually illuminated. A portion of the sun's light, however, is refracted or bent around the earth by its atmosphere, so that the moon's surface is dimly illuminated. At the time of the eclipse, an observer upon the moon would have seen the illuminated atmosphere of the earth encircling it like a halo.

LITERARY NOTES.

Modern Theories of Chemistry. By Dr. Lothar Meyer. Translated by Professors Bedson and Williams. Published by Longmans, Green, & Co., New York. Price $5.50.

When, some fifteen years ago, Professor Cooke published his *New Chemistry*, the fact that new theories of chemical philosophy had been advanced, and that the interpretations of chemical phenomena were radically different from those of former times, was first brought into popular notice. Since that time, however, the science of chemistry has continued to advance, and we now have the periodic law, the relations of chemical activity to heat, the dynamic and static phenomena of the atoms and molecules, and their general connection with physical phenomena, all of which are based upon the results of the investigations of the past few years. Dr. Meyer's work gives a full and exhaustive description of all the theories, both old and new, upon which the present science of chemistry is based, and will be a necessity to any chemist who wishes to keep abreast with the progress of the science. As one of the discoverers of the periodic law, the author is especially well qualified to explain its important relations to the general laws of chemical action; and we can most heartily recommend the work to every one who wishes to become acquainted with the "newer chemistry" of the past decade.

The same firm also publish *The Story of Creation*, by Edward Clodd, — a plain and popular account of the evolutionary theory and its relation to the life-forms of this earth in past and present times. Those who have not the time or inclination to read the more elaborate works of Darwin, Huxley, and Spencer will find in this book a full and fair presentation of the subject, written in a clear and easily understood style.

A Course of Lectures in Electricity, by George Forbes, F.R.S., is also published by this firm at $1.50. The volume is compiled from lectures delivered before audiences supposed to be unacquainted with electrical science, but desirous of obtaining sufficient knowledge to follow the progress now being made. To such persons this book can be strongly recommended, as it is plainly written, free from technical terms, and illustrated with numerous excellent engravings.

Home Experiments in Science for Old and Young. By T. O'Conor Sloane, Ph.D. Published by Henry Carey Baird & Co., Philadelphia. Price $1.50, free by mail to all parts of the world.

A book of this description has long been needed, and Professor Sloane's attempt to furnish a list of experiments not requiring expensive apparatus has been most thoroughly successful. It is wonderful how many important laws of science can be illustrated with apparatus which can be made at home out of the simplest and most inexpensive materials. Each experiment is fully explained, and vivid and accurate descriptions of the necessary apparatus are also added; thus making every thing so simple and easy to follow, that the youngest can work out the various suggestions. The print and style of the volume are admirable.

Outlines of Practical Physiology. By William Stirling, M.D. Published by P. Blakiston, Son, & Co., Philadelphia. Price $2.25.

This work was written to supply the wants of the students attending the author's course of physiology in Owens College, but is equally well adapted for all students of the science. Tests are given for the determination of the chemical substances formed in the living organism, and numerous experiments upon muscular, nervous, and other vital functions are fully described and illustrated. Physicians will find it particularly useful and interesting.

Practical Physics. By Professors Balfour Stewart and W. W. Haldane Gee. Published by Macmillan & Co., New York. Price 60 cents.

This work is especially designed for students in high schools and colleges, and largely consists of simple experiments and measurements in electricity and magnetism, and the explanations of the principles involved. Numerous practical details are given concerning the best and cheapest forms of apparatus, and the methods of their construction and management; rendering it a most valuable book to all teachers or students of the science.

The Manual-Training School: its Aims, Methods, and Results. By Professor C. M. Woodward, of the Manual Training School, Washington University, St. Louis. Price $2.00. Published by D. C. Heath & Co., Boston.

This book is exceedingly practical, its main object being to show just how a manual training school should be organized and conducted. It contains courses of study, programmes of daily exercises, and working drawings and descriptions of class exercises in wood and metal.

Messrs. Mariani & Co., 127 Fifth Avenue, New York, have published a book containing a full description of the natural history, chemistry, and physiological and therapeutical properties of *Erythroxylon Coca*. This interesting little book will be sent free to any physician upon application.

Pamphlets, etc., received: *A Review of Progress in Arts and Manufactures during 1887*, by William H. Wahl, Ph.D; *The Tail of the Earth* (25 cents), by William Danmar, Brooklyn, N.Y.; *The Construction of Maps in Relief*, by Messrs. John and Edward Harden; *The National Sin of Literary Piracy* (price 5 cents), Charles Scribner's Sons, New York; *How to Grow Strawberries*, by the editor of the *London Horticultural Times* and others; and *The Relation of Science to Agriculture*, by N. T. Lupton of Alabama.

From lack of space, the notice of several other volumes received must be deferred till next month.

Medicine and Pharmacy.

THE NATURAL FOOD OF MAN.

The question as to what constitutes the proper diet for mankind is one that has been hotly disputed. A small class of physiologists claim that health and strength are to be found in an exclusive meat diet, and that starch and gastric disturbance are synonymous terms. The much larger class of vegetarians abhor all food "which has ever lived," forgetting that the wonderful vital principle is just as surely present in a grain of mustard-seed as in a sheep or ox. Both classes, like most hygienic reformers, fail to take into account the different conditions which prevail in different localities and with different persons. An Esquimaux would soon freeze to death on the diet of rice which satisfies the Chinese cooly; while if the latter childlike individual attempted to sustain life by the blubber and walrus meat of his Northern brother, the Celestial mortality tables would probably form very agreeable reading for the average American statesman.

The widely differing diets upon which different races of men live and thrive show that the human constitution is exceedingly tolerant in this as in many other respects; but, as far as the structure of the body can give us any indication, it would seem as if the mixed animal and vegetable diet which is in general use is that best adapted to its welfare. The food provided by nature for the nourishment of the new-born infant is certainly an animal product. The sharp incisors and canine teeth appear first, while the heavy, blunt molars, so well adapted for grinding up the soft and bulky fruits and vegetables, appear later; the last "wisdom teeth," in fact, not being cut till adult age is nearly attained. A comparison of the human teeth with those of the carnivorous dog or cat and the herbivorous horse or ox will show very forcibly how the middle ground which mankind occupy is indicated by their dental formula, and the same relations have been noted in the digestive and assimilative organs.

Admitting, then, that a mixed diet is the best adapted to the human system, the question arises, How shall the proper proportion between the two classes of food be determined? Within reasonable limits we think this can best be left to the feelings of the individual. A hard-working laborer requires and relishes a more nitrogenous and stimulating diet than the clerk or shop-girl, whose labor is chiefly mental, and whose occupation requires them to remain indoors the greater part of the time. But the proper variety of food is also a personal peculiarity. "What is one man's meat is another man's poison;" and if one relishes and digests his food, and refrains from substituting stimulants in its place, he may be tolerably certain that his feelings will prove a safe guide, and he need not concern himself about the proper proportion of starches, sugars, or albuminoids in his daily diet.

Cholera is known in Chili as "the flail," — a very appropriate name.

[Original in *Popular Science News.*]

"THE CATARRH."

BY MAURICE D. CLARKE, M.D.

The word "catarrh," from a Greek verb that means to flow, defines properly, as used in medicine, any inflammation characterized by an excess of fluid secretion, although in this country it has been very commonly restricted to such inflammations of the upper air-passages alone. In France, however, it is applied indiscriminately to diseases of all the mucous surfaces (so called); and with us it is much more in vogue to speak of a catarrh of the lungs, catarrh of the intestine, etc., than it used to be. A catarrhal inflammation of the lungs, for example, is a well-defined condition, and one of marked contrast to the fibrinous inflammation, which is what we usually mean by the term "pneumonia," — distinctions of much theoretical and practical importance to medical men, though of necessity caviare to the multitude. Every-day speech, again, has so far narrowed the meaning of the word, that "the catarrh" is commonly supposed to be a specific affection; and when a patient comes to the physician with the statement that he "has the catarrh bad," the latter understands that he has probably nasal or pharyngeal affection, or both, to deal with.

Of the fact that more or less of us in this region "have the catarrh" to a greater or less degree, we have aural and ocular evidences in excess. Were we blind to other suggestions, we could not fail to be impressed by the insistance of the newspaper advertisements, whose loquacious and vivid description, minute as to detail and graphic as to fact,— some of them as "fetid" as the "droppings" they celebrate, — refuse us the boon of ignorance as to the varied forms of unpleasantness the symptoms of "the catarrh" assume. Suffice it to say that the sympathizing albeit somewhat wearied reader is borne along a torrent of woes until the climax of a general systemic decay impends, when he is devoutly grateful to learn that there is yet one hope of rescue for these travellers in the valley of the shadow of death, — A's pills or B's snuff or C's lotion, as the case may be. There is a grim suggestiveness of streaked floors and sawdust-filled spittoons in the "Hawk and Spit," the name of a bar-room not many miles from Boston. The nasal twang of the Yankee has become a matter of tradition, and not unjustly; while New-Englanders are said, in popular parlance, to "talk through the nose," though this is exactly what they do not do. When we have a "cold in the head" (i.e., a catarrh of the mucous membranes lining some of the cavities of the head), the congestion and secretion of those of the nose, when this is involved, occlude the passage, so that the resonance of the vocal sounds gained by the potency of this channel of air-supply is lost, and the voice becomes what we call nasal. We remember how Dr. Holmes has celebrated one of our well-known horse-jockeys as—

> "Budd Doble, whose catarrhal name
> So fills the nasal trump of fame."

Now, probably most of us look upon the nose as a double hole in the head by which we get, with more or less acuteness, a sense of smell, and through which we occasionally breathe. The intricate mechanism, and the skilful adaptation of means to end, which, in common with the other organs of special sense, it exhibits, naturally do not reveal themselves to any but the students of anatomy and physiology. Its fourteen bones are probably better hidden than any other fourteen bones of the body, and assist in converting what would otherwise be a mere channel of communication, into a series of cavities designed and adapted for particular purposes. The arch of four bones which forms the bridge of the nose, and which is of such strength as to enable the gymnast of the circus to perform the feat of supporting with it a man on a ladder, is pieced on with cartilage to form the nostrils, through which the nose communicates with the outer air. Similar openings behind connect it with the upper and posterior parts of the mouth. The space between these anterior and posterior openings makes a large chamber, divided by a vertical wall into halves, each of which is still farther separated into three irregular cavities by three bones, called spongy, from the porosity and delicacy of their texture. The ceiling of these chambers is formed by a bone of the thinness of paper, upon which lies the front part of the brain, — a fact the Egyptians made use of in embalming their corpses, easily crushing this bone, and extracting the brain through the nostrils. The bone is called cribriform (sieve-like) because it is perforated by many minute holes, through which, from the olfactory bulbs (specialized parts of the brain in which is resident the capacity of smell) that rest on its upper surface, issue the delicate filaments of the olfactory nerves, to spread themselves over the lining membrane of the two upper spongy bones. It is in the upper chambers of the nose, therefore, that the function of smell is performed; the nerves that supply the lower spongy bone being entirely unconnected with the organs of smell. Over these latter, however, sweep in and out the currents of air when the act of respiration is properly carried out, and it is these that are especially concerned in its abnormal performance. Usually but a very little of the volume of air that traverses the lower chamber of the nose has any influence upon its upper regions; and therefore, when our attention is attracted by an odor, we sniff, in order to bring a larger quantity of air into contact with the higher parts of the nose, or olfactory cavities, where odors are perceived.

But the half has not been told of the anatomical and physiological arrangements of the nose. By minute openings its chambers have communication with many other parts of the head, — with the hollow that forms the greater part of the cheek-bone; with the eye by a minute spout that carries off the lachrymal secretion, unless the tears are so abundant as to roll down the cheeks; with the front of the roof of the mouth; with the abundant cells of the bone that makes the forehead, and the congestion of whose lining membrane probably accounts for the severe headache that so often accompanies and aggravates a "cold in the head." The gateway to the inner air-passages, its abundant surfaces raise to the temperature of the body the air inspired, supply it with the moisture it lacks, and sift from it more or less of the mechanical impurities with which the atmosphere of our houses and shops is laden.

It may easily be imagined that an apparatus so complicated would be liable to disarrangement, and that, exposed as it must be to all sorts of irritation, chemical, mechanical, and atmospherical, it would show the effects of exposure. How susceptible it is to minor irritations, how readily we sneeze when we do not want to, how quickly a draught of air excites its secretion, we are daily witnesses in our own persons. Trifling annoyances of this sort we meet with every day. If, however, the irritation be sharp enough, or repeated often enough, there results an inflammation which goes under the technical name of rhinitis, which may be of any grade of severity, and may be either acute or chronic. Acute rhinitis (acute coryza, as it is sometimes called) is usually a temporary and trifling matter, provoked most commonly by the causes that provoke "colds," whatever these may

be, and easily gets well without treatment, although more or less comfort may be obtained from applications, and it is even possible, if the case is seen in the earliest stages, to stop it then and there, or, as it is said, "abort the attack." This happy consummation is not often attained, and an acute rhinitis, generally a distressing feature of a cold in the head, usually runs its own course of a few days, and gets well, or runs on into a more or less chronic form.

Chronic rhinitis has three forms of marked difference in fact as well as in nomenclature. The first is known as simple chronic rhinitis; that is, an uncomplicated chronic inflammation. The second is called hypertrophic rhinitis, because it is attended by an hypertrophy (increase) of the tissues involved. The third, directly opposed to the second, is atrophic rhinitis, because it occasions an atrophy (decrease) of the tissues involved. Simple chronic rhinitis is the continuance of a trouble once acute, and which goes on and on, scarcely heeded by the sufferer. The discharge is constant, is rather thin, and easily removed. There is no obstruction of any moment to breathing, no alteration in the sense of smell, no pain. The disease is an annoyance, but not very hard to endure. And so it is that after a while simple rhinitis lapses gradually into a later stage, or hypertrophic rhinitis. In this condition the discharge is thicker, more tenacious, less easily removed. The membrane which secretes it, and which covers the nasal chambers, increases so as to take up part of the space naturally allotted for the passage of air, and thus occasions difficulty in respiration, — a difficulty which is likely to be re-enforced at every fresh attack, when a new congestion of the surface is superadded to the existing hypertrophy. The troublesome breathing, the nasal tone, the general sense of discomfort, send patients in this stage to a physician, whose examination will generally discover the membrane of the lower air-passages irregularly swollen, so as to occlude with more or less completeness the air-channels, and covered with a thick muco-purulent secretion. The third and uncommon stage is due to the contraction of new tissue that is formed by the inflammatory processes. The new growths that blocked the way in the former stage are shrunken in this, so that there is no obstruction to respiration, and no alteration in the voice. The discharge is altered; instead of being profuse and liquid, it is scanty and dry, forming crusts and scales. In the cavities formed by the irregular deposition of tissue, some of the secretions may be retained and decomposed, the resulting odor giving the name of fetid catarrh or rhinitis to this condition.

One of the main difficulties attendant upon the cure of nasal catarrh is the time and patience required. We are all apt to prefer the inconveniences of the milder forms of disease to the inconveniences of getting them cured. And the cure of "the catarrh" demands not only the physician's skill, but its oft-repeated exercise.

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[Specially compiled for the *Popular Science News.*]

MONTHLY SUMMARY OF MEDICAL PROGRESS.

BY W. S. WELLS, M.D.

Successful operations for the removal of foreign bodies in the windpipe are always interesting reading, and one of the most important cases of this nature yet published was brought before the Medico-Chirurgical Society, London, lately, by Drs. Cheadle and Smith. The patient was a girl nine years old, who had drawn into her throat the loose metallic cap covering the end of a pencil which she had been holding in her mouth. Immediately urgent choking and difficulty of breathing followed, which was soon relieved by the passage of a probang down the œsophagus; and it was believed, notwithstanding the great pain and coughing at the time, that the foreign body had been pushed into the stomach.

Four days after the accident, dulness on percussion, and imperfect entry of air into the left side of the chest, were noticed. A week after this there was almost total absence of respiratory murmur on the same side; air entering only over a limited portion of the upper part in front, with great retraction of the left side of the chest, showing that the lung must have been much collapsed. The pulse and temperature remained normal; there was no difficulty in breathing, but occasional short cough, aggravated by exertion. The conclusion arrived at was, that the metallic cap, measuring an inch and a quarter, was lodged at the extreme end of the left bronchus; and it was decided to attempt its removal by tracheotomy.

Provision was made for dealing with whichever end of the cap should present, though it was expected that the open end would be towards the mouth; and for this, a pair of suitably curved forceps with external grip was provided.

The isthmus of the thyroid was divided between two ligatures, the trachea freely opened, and the edges of the tracheal wound attached to the edges of the skin wound by silk sutures, so as to keep the trachea widely open. A long probe was now passed into the bronchus, and at once detected the foreign body in the position assigned to it, and with the open end uppermost.

Removing the sound, the forceps were introduced, and the cap extracted without the least difficulty. The lung slowly expanded, and fourteen days after the operation the patient was substantially well, the wound having been allowed to granulate.

The chief point in the operation was the wide incision made into the trachea, and the stitching of this to the skin wound, which kept it wide open, which was found to be a great convenience during the operation, as, when the trachea is held open by hooks, these are very apt to slip; and even if they do not, the hands of those holding them are likely to be in the operator's way. Mr. Smith said he had taken the idea of the forceps from those used in intubation, which have an external grip.

He pointed out the great difference in prognosis according to the nature of the foreign body, and related a case where a large sugar-plum had passed into a child's trachea, and in the course of ten minutes or so had become completely dissolved, all symptoms of obstruction passing away.

Prostatic disturbances incident to advancing years have hitherto been treated with such palliative though often ineffectual measures as could be afforded by the use of the catheter and the exhibition of drugs.

But now operative procedures are claiming notice, the most recent of which was advocated by Mr. McGill at a late meeting of the London Clinical Society.

The operation itself consists in opening the bladder above the pubes, in the usual manner, and removing with scissors and forceps that portion of the enlarged prostate which prevents the outflow of urine. Mr. McGill reported three cases in which the operation had been successfully performed, affording in all the cases immediate relief from years of misery.

A case of re-section of the left lobe of the liver, the disease having been caused in a woman about thirty years of age, by tight lacing, is related in the *Berlin Klin. Woch.* by Dr. Langenbuch. The tumor was of the size of the fist, dense, elastic, not fluctuating, moving with respiration, and its dulness continuous with that of the liver. It was located in the epigastrium, and caused pain both on standing and on lying down. The diagnosis lay between hydatid tumor and deformity from tight lacing. An exploratory incision proved that the case was the latter, but involving the left lobe. The portion of the lobe forming the tumor was practically isolated from the rest of the organ by a broad but ligamentous pedicle, and therefore was functionally of no service. Dr. Langenbuch decided that it was advisable to remove the source of so much distress. Accordingly the pedicle was transfixed by ligatures, and the lobe excised.

After running the gantlet of secondary hemorrhage and an attack of ascites, the woman recovered.

The portion of liver removed weighed about twelve ounces. Injuries to the liver from tight lacing usually involve the right lobe but this case shows the feasibility of removing either lobe when degenerated so as to become functionally inert.

At the London Medical and Chirurgical Society Dr. Gowers recently showed a patient from whose spine a tumor was successfully removed. He had suffered severe pain for about three years, located just below and inside the angle of the left scapula, and it was accompanied by absolute loss of motion and sensation of the body and limbs below that level.

Mr. Victor Horsely removed the spines, and parts of the laminæ of the fifth and fourth dorsal vertebræ; but not until the third vertebra had been similarly opened, did the tumor come into sight. It was a small oval myxoma, compressing and making a deep impression on the left side of the spinal cord below the third vertebra. It was easily shelled out, and under careful antiseptic treatment the wound healed, but for three or four weeks the pain did not abate. After that, however, it decreased, until, seven months after, it is entirely gone, and the sensation and motion of the body and legs are almost completely restored. This is stated to be the first time such an operation has been attempted.

In cases of greatly contracted pelvis, endangering both the mother and the unborn infant, Dr. MacEwen suggests the substitution of subcutaneous osteotomy for abdominal section. He claims to have demonstrated that section of the pubic bone an inch and a half or two inches from the symphysis pubis, and section of the ascending rami of the ischia, would add one and one-half inches to the antero-posterior diameter of the pelvis, and that, in case more room is required, the ilium could be divided on each side. The operation has never been performed yet upon the living subject, but Professor MacEwen holds himself ready to perform it when called upon. Candidates for the *Cæsarian Section* will bear this important announcement in mind.

Chronic poisoning by coffee has received some attention by Guelliot of Reims. Coffeeism is found in a class directly opposite to those in whom theism is found, the former being liable in well-to-do overfed individuals, while theism is found in half-starved women who are accustomed to carry on the most severe toil, with scarcely any other food than crackers and tea. The symptoms of coffeeism are anorexia, or want of appetite, sleeplessness, and nervous tremblings, with various evidences of indigestion and non-assimilation, torpor of the liver, and non-elimniation of tissue waste. The emunctory system is clogged. In theism the treatment is rest and nourishment; but, unless the

patient has used coffee to stimulate his brain during mental strain, his condition is that of the gourmand whose system requires unloading, and who, instead of rest, should be made to exercise on low diet, with coffee left out.

In the *Anatomischer Anzeiger* is a curious article on "Epidermal Pigment and Epidermal Alimentation." Experiments by Karg, Kolliker, and Abey demonstrated that the skin of a white person transplanted on the skin of a negro became as black as the skin of the negro. On the contrary, the skin of a negro inoculated on the skin of a white person lost its pigment, and became as white as its surrounding tissue.

Gersung, *Centralbl. f. Chir.*, employs wicking impregnated with iodoform, in place of strips of gauze, as a tampon for wound-cavities. Many disadvantages are pointed out connected with the use of gauze, especially in cavities; while the advantages claimed for the wicking are, that a sufficient length of the wick may be used to fill up the cavity, while the end left to protrude is no larger than a drainage-tube, and its removal is readily accomplished. This dressing is said to have been adopted in several Vienna hospitals. In Billroth's Clinic an iodoform-tannic wick is employed as a tampon, made by sprinkling iodoform wicking with tannic acid. If the discharge from the wound is great, a drainage-tube should be combined with the medicated wick.

The sulpho-benzoate of soda for the dressing of wounds was particularly lauded by Dr. Heckle at a recent meeting of the Academy of Sciences, Paris. The results claimed has been so satisfactory, that the doctor considers this agent far superior to any and all antiseptics now in use, and with none of the objections pertaining to most of them.

[Original in *Popular Science News.*]

MEDICAL MISCELLANY.

BY DR. S. F. LANDREY.

Sick-Headache.— The headache of indigestion, accompanied by scotoma, or scintillations and dazzlings of light before the eyes, is always due to acidity and evolution of gases in the stomach. When not accompanied by aphasia or by a want of co-ordination, it is easily cured by common saleratus or supercarbonate of soda. Let the patient take one-fourth of a teaspoonful in much water, — say, four to six tablespoonfuls, or more, — wait a few minutes, and if not relieved repeat the dose. The glimmering soon ceases, and the pain forgets to follow. Hot water can be used if the stomach is very weak, and Bondault's pepsin will sometimes relieve it without the soda.

Glycerine as an Infusoricide. — The writer would draw attention to the fact that glycerine is a potent destroyer of infusorial life. To a microscopist every thing visible becomes a subject for microscopy. Hence, in passing a turbid mud-hole by the roadside, a small vial of the filthy water was secured, to ascertain "what was in it." Euglenias, rotifers, kolpodes, and all manner of curious animalculæ were found. After enjoying the sight for a while, like any other child, I desired to tear down the cob-house my fancy and microscope had built up for observation. One agent after another was tried on separate portions, till finally glycerine was obtained, and a drop of it in their midst worked wonders. It must have effectually shut out the air, as grease does when a fly drops in it; for no sooner had it mingled with the water than "every mother's son" of an animalcule died, nor could the addition of fresh water bring them to life. Numberless experiments confirmed the results then obtained. Glycerine, however, will not destroy vinegar eels.

Overheat as a Cause of Disease. — *Coup de soleil* is an acknowledged cause of many deaths, and a fruitful source of cerebral trouble in after-years to those who survive a severe attack of what is popularly known as sunstroke. But let me add a word of caution to women who cook and have to toil over heated stoves, and in the close, hot air of overheated kitchens, against *coup d'étuve*, or stove-stroke. Before the old-fashioned open fireplace our mothers and sisters suffered much from the effects of direct heat in the face; and in browning coffee, boiling, and baking, they would often be well-nigh overpowered with the heat. Here, however, was an occasional relief, by the moving of cold currents to the open fire, that worked to their benefit. Moreover, with the introduction of stoves came the building of smaller rooms for kitchens, and the consequently greater accumulations of heat about the stoves, especially when washing, ironing, and baking, that in time proved a prolific source of bronchitis, asthma, headaches, and disturbed circulations. Diseases have multiplied aggressively with the increase of patents, till at present it is no uncommon thing to find abundant work for those who treat respiratory diseases in almost every household where stoves are commonly used Especially is this the case where proper ventilation is not secured, and ample room given to cooks to occasionally escape the effects of direct stove-heat.

I slept one night in a small bedroom in which was a small stove. The night was a cold one in winter. The stove was filled with wood, and all the dampers closed to prevent rapid burning. It proved, however, to be full of open joints, and at length a furious fire was the result. I awoke bathed in sweat, suffocated almost to smothering, roaring in the ears equal to a railroad train, dizziness so great I could hardly get out of bed to attend to opening doors and cooling the stove. What I suffered has given me a sympathy for those who must endure, only in less degree, the heat of kitchen stoves. No wonder that apoplexy, epilepsy, cerebral congestion, and congestive headaches, severe colds, and bronchitis, are the common ailments of those who suffer from *coup d'étuve*. Beware of overheating yourself or your babies; keep baby's feet, and not its head, toward the stove.

Milk Sickness — The English synonymes of sick stomach, swamp sickness, tires, slows, stiff joints, trembles, puking fever, river sickness, aptly describe some of its symptoms. It is about the only word, as the name of a disease, for which Dunglison could not find, or at least does not give, about *seventy-five* Greek, Dutch, Latin, French, and German synonymes. Most of the works on medical practice wholly ignore its existence, or show their wisdom in ignorance by saying nothing about it.

Dunglison says truthfully, "It is attributed in cattle to something eaten or drunk by them, and in man to the eating of the flesh of animals laboring under the disease." But he makes another statement, "It is endemic," which is not borne out by experience: for, out of a hundred head of cattle grazing over the same ground, perhaps not more than six to a dozen will become affected; and of those families who use the milk, some will not feel any serious effects, others will be prostrated, and others again in the same family, perhaps, be slightly nauseated, and feel badly for a few days. But to those who are in a susceptible condition, and receive a sufficient quantity of the poison, it is certain death without speedy and intelligent relief.

The symptoms are those which the same author gives for acronarcotic poisons. In 1854-56 Carroll County, Ind., near Lockport, was much annoyed by this fearful ailment. In company with my preceptor, Dr. M. A. Parr, I visited a great many who were thus afflicted. But we never gave an emetic, except at the very commencement. Emetics are too exhausting, and the patient's strength must be well husbanded, or in the relapsing stage he will sink from sheer exhaustion. I have seen a hollow in the epigastrium that would receive a good-sized cup, and the bowels so dry they would almost rustle like autumn leaves. Mucilaginous drinks, an active purge, followed, if ineffective, by large clysters of soap and water, or salted gruel, repeated till effective, followed by supporting treatment of tonics, ammonia, beef-tea, etc., never failed, except when the patient was already beyond the reach of help. The cause of milk sickness is the *Rhus toxicodendron*, the leaves of which are eaten by cattle, and communicated to their calves through their milk, and to humanity through both milk and flesh. I suggested the above to my preceptor, and we tried and proved it to be true, and at this late day I give it freely, that others may know the cause, and be able to save lives that may be in jeopardy.

Retreating Foreheads. — Business-men generally recognize the importance of active mental powers and perceptivity in their subordinates. Thinkers will always be in demand; but the more active seamen, laborers, bookkeepers, typewriters, shorthand writers, telegraphers, clerks, ticket agents, and rapid as well as accurate talkers, writers, and accountants, will be in still greater demand. With the increase of inventions, the introduction of new machinery and newer methods of business, come also the well-trained, active hands, brains, and tongues of those who are to take the places of the slow-plodding, old-fashioned business-men. Men must now *know* what they are doing, and what they will or can do under all the possible changes and environments of their situations in life. Deception, sharp trading, adulteration, and often unprincipled competition, face honest men. With these overwrought but dishonest perceptive intellects, sharp as an edge-tool in their specialties, must the fair-minded and slower-acting but more deeply thinking men compete. Fortunes are often made or lost on the spur of a moment. Quick apprehension, rapid decision, far-seeing, comprehensive thought, — feminine intuition, one might say, — that decides first and thinks afterward, is what the business-men of to-day need and seek: an accuracy of observation that decides of a man, whatever his pretensions may be, at a single glance. The war of secession dried up many of the fountains of extravagance and ignorance. Utility came to the front. Men of beauty, thought, talents, and wealth were tried and condemned. "What is he?" "what does he know?" "who were his ancestors?" were seldom asked. "What can he do?" became the question of the hour. He only who could accomplish was in demand. By the people only real necessities were asked for or purchased, and really perceptive men were those who reaped the harvests during the war. Men of retreating foreheads made the war, fought it through, reaped its benefits, and settled down to think after the work was done. We do not mean that reason was ignored, nor that these retreating foreheads lacked in intellect or wisdom; but we do say, and mean

it, that from the inception of that war men have placed action in the vanguard, and meditation in the rear, of the army of progress. Lecturing today is a thing of the past, unless accomplished by men of fire and experience. Men who can say much in little, and say it well, who know when to speak, how long to talk, and when to cease, are the men desired and sought for. He who has learned to put fire in his speech, and a superfluity of notes in the fire, whose brows project beyond his eyes, who has a retreating forehead, is the one who occupies the rostrum, the pulpit, and the bench.

PATENT MEDICINES.

Professor Chandler says: "These firms of manufacturers of proprietary medicines, nine out of ten, live solely by the newspapers, and sometimes are admirably managed. I know some establishments in which there is a regular staff employed; I know something about them, because they try to bribe me to certify to the value of their concoctions. As I say, there is a regular staff. There is the literary man, who writes the letters, giving marvellous accounts of marvellous cures; there is the artist, who shows the patient before and after taking twenty-two bottles of the medicine; there is the poet, who composes poems upon the subject; there is the liar, who swears to what he knows isn't true, and the forger, who produces testimonials from his own imagination. Without exaggeration, I should say that nine out of ten of these proprietary medicines are frauds, pure and simple; the real business is advertising for dupes. The medical part of it is but a side issue. I am pretty sure, if I were to pound up brickbats, and spend a hundred thousand dollars in offering it at a dollar an ounce, as a sure cure for some disease which cannot be cured, I should get back at least a hundred and ten thousand dollars, thus giving me ten thousand dollars for my trouble. Nine-tenths of the medicines sent out in this fashion have no more curative properties than brickbat dust." — *Medical Record.*

MEDICAL MEMORANDA.

How to Abort a Felon. — Dr. John T. Metcalf writes to the *Boston Medical and Surgical Journal:* "In 1839 I learned that a felon could, if seen early enough, be made to abort by wrapping the finger-end with narrow strips of adhesive plaster. When pus has been formed, I learned twenty years ago, from a country doctor, that immediate relief and speedy cure would follow the gentle, slow separation of the nail from its envelope by means of a penknife blade, not too sharp, at the point nearest the seat of greatest pain. Very soon a drop of pus shows itself, and relief comes. I am aware that the plan described is known to many medical men. It was not known to me at the time referred to, when the country doctor showed me how to treat a paronychious patient whose finger I was about to lay open by the 'free incision down to the bone,' taught in the lessons of my great masters."

Internal Use of Glycerine. — Dr. Tisne asserts that glycerine taken internally exerts a beneficial effect upon nutrition, increasing the weight, and palliating many of the distressing symptoms of phthisis, such as loss of appetite, diarrhœa, night sweats, and insomnia. Its action on the liver is manifested by an increase in the size of the organ, and a more abundant flow of bile. It has a diuretic effect, and increases the excretion of urea, the chlorides, and phosphates. The alkalinity of the urine is diminished; and if any pus be present in this, it is greatly lessened in amount.

The "Cannon-Ball" Cure. — In the treatment of chronic constipation, the light ammunition heretofore in use in the form of pills will be replaced by cannon-balls. Dr. Sahli highly recommends them in that affection, the ball to be rolled about over the abdomen every day for five or ten minutes at a time. The ball should weigh from four to five pounds.

An Elegant Seidlitz-Powder Solution:

Solution No. 1.

℞. Sodii bicarbonatis . . . . . ʒij.
Potassii et sodii tart. . . . . ʒij.
Syr. aurantii cort. recent. . . . . ʒvi.
Aq. gaultheriæ ad. . . . . ℥ij.
M. ft. sol.
Sig. — Pour in a goblet half full of cracked ice.

Solution No. 2.

℞ Acid tartarici . . . . . gr. xxxv.
Syr. aurant cort. recent. . . . . ʒss.
Aq. gaultheriæ ad. . . . . ʒj.
M. ft. sol.
Sig. — Add to No. 1, and drink while effervescing.

This forms an agreeable and effective aperient, devoid of any saline taste, effervescing slowly, and contains the virtue of one sedlitz powder, United States Pharmacopeia, 1880.

This may be prescribed in quantity, as it will keep indefinitely.

The taste is as agreeable as soda-water. Aromatic sirup may be used if it is desired. — H. S. Brookes, *in St. Louis Courier of Medicine.*

Then and Now. — The following figures are taken from an old price-book of one of the leading drug-stores in this city, and show the great decrease in price of many medicines in recent years: Acid hydrocyanic, 25 cents a drachm; acid succinic, $300 an ounce; alcohol, 25 cents a pint; brucine, $50 an ounce; delphine, $80 an ounce; emetine, $36 an ounce; linium usitatissinium, 17 cents a pound; morphine, $50 an ounce; narcotine, $100 an ounce; sulphas cinchonæ, $10 an ounce; sulphas quininæ, $1.50 a drachm; hatcase (oiled silk), $1.50 a yard; Prussian blue, 25 cents an ounce. Tinctures were 6 or 12 cents an ounce; ointments, 12 cents an ounce; and sirups, 6 cents an ounce by weight, or 8 cents by measure.

HUMORS.

A Little Boy fell in convulsions on the street one day, and the doctor was hastily summoned. "Has he kicked the bucket, doctor?" asked one of the crowd. "No," returned the doctor: "he has only turned a little pale."

Hydrophobia. — In an up-town horse-car a day or two ago, a passenger was groaning and twisting about on his seat.

"Are you suffering, sir?" asked a sympathetic neighbor.

"Suffering? I should say so. I've been bitten by a mad dog," said the man with energy, "and am on my way to the doctor."

Sudden silence fell upon the passengers; and before the next crossing was reached, the suffering gentleman had the car all to himself.

One Dose. — *Doctor* (to convalescent patient): "I have taken the liberty, sir, of making out my bill."

Patient (looking at bill): "Great heavens, doctor! you don't expect me to take all this in one dose?"

About to Change his Profession. — "Trampin's played out," said a sad-looking specimen of his tribe, as he hugged the red-hot stove in the station; "trampin's no good any more, an' I'm goin' to change my perfeshun."

"What are you going into?"

"I'm goin' to be a mind-cure doctor."

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Publishers' Column.

In writing to advertisers about articles referred to in this journal, it would be conferring a favor upon both the advertisers and the publishers if you would kindly mention the "Science News" as the source of your information.

The latest use of paper is for making chimneys. The Esterbrook Pen Company will still use the best steel in making their celebrated pens.

Back Numbers wanted. — Full price will be paid at this office for copies of the *Boston Journal of Chemistry* for November, 1879, and December, 1886. Address the publishers of this paper, 19 Pearl Street, Boston.

Attention is called to the advertisement of Messrs. Longmans, Green, & Co., the well-known London publishers. Their branch house in New York enables them to supply promptly the latest English and foreign publications.

Dr. H. R. Walton, Annapolis, Md., writes: "Colden's Liquid Beef Tonic is a most excellent preparation. It is par excellence. Superior to cod-liver oil or any thing I have ever used in wasted or impaired constitutions."

Do you intend to paint, this spring? If so, send to the U. S. Gutta Percha Paint Company, 131 to 135 Matthewson Street, Providence, R.I., for a valuable pamphlet on decorative and preservative paint. Mention the *Science News.*

J. Leonard Corning, M.D., writes concerning coca: "It has the soothing effects of the bromides, but without their characteristic depressing influence. The preparation of coca known as Mariani's Coca Wine is, so far as I know, the best in the market. It possesses the decided advantage of being manufactured from the fresh leaves, which is an indispensable requisite."

Dr. W. S. Leonard, Hinsdale, N.H., says: "I have used Horsford's Acid Phosphate in my practice for the past eight or ten years, and have been much gratified with the results obtained from its use. In various forms of dyspepsia it reaches a class of cases that no other medicine seems to touch, and I have repeatedly seen patients, where opiates were contra-indicated, obtain refreshing sleep and rest at night from a single dose at bed-time."

Chicago, Dec. 28, 1887.

Dear Sir, — It gives me pleasure to state that your refrigerating machinery used by us has met with our hearty approval, doing more work than expected, and always reliable. One 50-ton machine has been at work six years, and the other 50-ton machine five years.

Your late improvements add greatly to the efficiency, economy, and ease of handling the machine. We believe your machine fully equal to any made.

Yours truly,
F. E. Vogal, *Sec'y Fairbank Canning Co.*

The Popular Science News

AND

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CONTENTS.

FAMILIAR SCIENCE.—Dew and Frost 65
The Common Dandelion 65
The French Academy of Sciences 67
The Diffraction of Sound 68
Scientific Brevities 68

PRACTICAL CHEMISTRY AND THE ARTS.—Glass and Porcelain Painting 69
New Methods in Analysis 69
Liquid Amalgam 69
Surface Condensation of Glass 69
Chloride of Nitrogen 70
Asbestos for Filtration 70
A Substitute for Hydraulic Cement 70
A Test for Saccharin 70
Practical Recipes 70
Railroad Notes 70

HOME, FARM, AND GARDEN.—The Chemistry of the Dairy. 71
Peat 71
The Bird-Foot Violet 71
What Flowers will grow in the Shade? 72
Allspice 72
Horticultural Hints 72

EDITORIAL.—Quantivalence 73
The Snow as a Bird-Catcher 74
Berlin Letter 74
How Birds learn to Sing 75
Astronomical Phenomena for May, 1888 75
Meteorology for March, 1888 76
Questions and Answers 76
Literary Notes 76

MEDICINE AND PHARMACY.—Man as a Steam Engine 77
Simple Sphygmographs 77
The Coca-Plant 77
The Functions of the Supra-Renal Capsules 78
Medicine for the Imagination 78
Monthly Summary of Medical Progress 78
Pharmaceutical Notes 79
Select Formulæ for Dentifrices 80
Medical Memoranda 80

PUBLISHERS' COLUMN 80

Familiar Science.

DEW AND FROST.

IF, after a clear, cool night, we observe the surface of the ground, we often find it covered with moisture, as if it had rained during the night. This familiar phenomenon, known as the fall of the dew, is dependent upon some very interesting and important scientific principles.

Air possesses the property of holding a certain amount of water vapor, the quantity depending upon the temperature. If, at a temperature of 60°, for instance, a cubic foot of air held as many grains of water in the form of vapor as it was possible for it to do, it would be said to be *saturated*, just as a quantity of water would be saturated with salt when no more of that substance could be dissolved in it. Now, if the temperature of the air was increased to 70°, its power of absorbing water vapor would be increased; and if it was in contact with water or a moist substance, evaporation would commence, and continue until the air was saturated once more. If, on the contrary, the temperature of the saturated air was lowered, it would become more than saturated, and the excess of water vapor would be precipitated out in the form of finely divided particles.

One of the most familiar examples of this phenomenon is shown by our breath on a cold morning, when the water vapor in the warm moist air from our lungs, on passing into the colder outside air, condenses in the cloud-like form so frequently observed. When this takes place in nature, on a large scale, by a cold and a warm body of air coming together, fogs, clouds, or rain are produced.

It is a curious fact that the water thus precipitated from a state of vapor is not in the form of little drops, but of hollow vesicles, as they are termed, like minute soap-bubbles. This peculiar form is common to condensed water vapor, whether in the form of steam escaping from a teakettle or boiler, or the fogs and clouds which float in the air. It is only when the vesicles unite together that ordinary drops are formed. This vesicular structure probably helps in maintaining the clouds at their high elevation.

Whatever the quantity of vapor in the air, there is a certain temperature at which the vapor begins to precipitate, known as the *dew-point*. If a goblet filled with ice-water is brought into a warm room, the air immediately surrounding it is cooled below the dew-point, and a copious deposit of water is formed upon its sides. This water does not ooze out through the glass, as some people suppose, but is squeezed out of the air, as it were, by the cooling effect of the ice.

We thus see that it is only necessary to cool the air sufficiently to obtain a copious deposit of moisture, and if the temperature of the ground should fall low enough, dew would certainly be precipitated upon it; but it is noticed that dew falls upon warm nights, when the temperature of the air is far above the dew-point. What, then, causes the cooling of the earth upon which the dew is so abundantly deposited?

This is best explained by the principle of radiation. If we hold our hand at some distance from a block of ice, we shall feel the cold very perceptibly. The hand radiates its heat towards the ice, which absorbs it so rapidly that the temperature of the hand is lowered, and a sensation of cold is felt. Now, just above the comparatively thin stratum of air which surrounds our earth are the regions of space where the temperature is far lower than any with which we are acquainted; and it is to these cold regions that the heat of the earth, the grass, and other bodies is radiated in the clear summer nights, after the heat of the sun is withdrawn. As they become cooled by radiating away their heat, they reduce the temperature of the air surrounding them below the dew-point, and the dew is thus precipitated, not by "falling," as the common phrase implies, but from the air immediately in contact with the object on which it is deposited.

This theory of the formation of dew also explains many of the accompanying phenomena. A gentle wind favors the deposition of dew, as it brings fresh supplies of moisture-laden air into contact with the cold earth or foliage. A brisk wind, on the contrary, prevents its formation, as the air does not remain long enough in contact with the cool bodies to deposit its moisture. No dew falls on cloudy nights, because the clouds act as a screen, and prevent the radiation from the earth's surface to the colder regions beyond.

It is noticed that the dew is not deposited in equal quantity upon different substances. A bright piece of metal exposed on the ground will remain quite dry, while the surrounding grass will be loaded with moisture. This is due to the fact that different substances possess different capacities for radiation. In general, it may be said that dark-colored, rough bodies are good radiators, while smooth, bright substances are poor ones. Air also is a comparatively poor radiator, or else it would cool itself down below the dew-point, and form fogs, much more frequently than at present.

Hoar-frost is, of course, simply frozen dew. In the spring and autumn the temperature of the earth may not only fall below the dew-point of the air, but even below the freezing-point of water. The flocculent form in which hoar-frost is often deposited shows that the ice has been formed directly from the condensing vapor, without passing through the intermediate stage of water. In some parts of India ice is manufactured by this means: shallow earthenware dishes of water are exposed to the clear sky at night, and the water is often frozen even when the temperature of the air is as high as 50° F. Early crops are often frozen in the same way; and farmers sometimes build bonfires in their fields at night, so that the smoke shall form an artificial cloud, and prevent the radiation and consequent cooling. Finally, the beneficial effect of the heavy dews of midsummer to the crops, when parched with drought, is of great value, and they replace to no small extent an insufficient rainfall.

[Original in *Popular Science News.*]

THE COMMON DANDELION.

BY FREDERICK LEROY SARGENT.

IN the various names which the dandelion has received, we see expressed, for the most part, either a reference to the tooth-like recurved lobes of the leaves (Fig. 1), or an allusion to the medicinal properties of the plant. Thus, our English name is a modified form of the French *dent de lion*, meaning lion's tooth, and in German we have the same idea expressed in *Löwenzahn*. Fifty years ago this plant appeared in the botanies as *Leontodon taraxi-*

cum, the geueric name beiug derived from the Greek *leon*, lion, and *odons*, tooth, and the specific from the Greek *tarasso*, to stir up, in reference to the effect of a dose. In later works we find the genus *Leontodon*, including the "fall dandelion" (*L. autumnale*), but not the true dandelion, which now appears in a genus by itself under the name *Taraxicum Dens-leonis*. Here the specific name is merely "lion's tooth" again, in Latin. Finally in the latest works our plant is given as *Taraxicum officinale*, since this has been found to be the name which, according to the rules of botanical nomenclature, takes precedence of all others. An allusion to the teeth is thus no longer retained, the only reference remaining being to the plant's officinal use.

FIG. 1.

To the majority of people the mention of the dandelion calls to mind not so much its medicinal properties as its use for food. Although its cultivation, either as a spring potherb or as a salad with blanched leaves, is comparatively modern, the wild plant seems to have been long valued as a vegetable. There is reason to believe that the Romans made use of it as a potherb, and Chinese writers of the fourteenth century mention its being eateu in their country, although there is no evidence of cultivation at that time.

There are but few of our flowering plants that grow so widespread over the world. It occurs in North America from the Atlantic to the Pacific coast, in Europe, in Asia, and in the arctic regions. This extensive range may in part be accounted for by the fact that our plant belongs to the large and aggressive family of the *Compositæ*, and is thus related to such invaders as daisies, burdocks, and thistles. Still, the dandelion has more to recommend it than mere family connection: for, despite its lowly aspect, it is no poor relation; but, as we shall hope to show in the present article, it has many virtues of its own which entitle it to respect.

Prominent among these is its adaptability to the different conditions under which it grows. It seems to make the best of every thing. If by chance a seed falls upon poor, thin soil, the young plant sends forth, as rapidly as possible, a rosette of leaves pressed close to the earth; and thus, on the principle that "possession is nine poiuts of the law," it secures for its roots the use of a certain amount of territory quite safe from the encroachments of other plants. In rich ground the case is quite different, for here there is so much nutriment in a small quantity of earth, that the struggle for soil is not such a life-and-death matter as in the less favored localities. Consequently we find a large number of plants crowded together as close as they can stand; and it is obvious that if, under these circumstances, the dandelion should develop a flat rosette of leaves, the grass and other plants growing around would soon overshadow it, and it would have small chance for life. Our plant therefore extends its leaves upwards, and does its best to elongate them so as to keep pace with the growth of its rivals. But as these are for the most part grasses and plants which grow by elongation of the stem, the race for sunshiue is rather in favor of these other plants, for the reason that a given amount of matcrial put into a stem makes a stiffer organ than when put into a leaf. Still, even with these odds against it, the dandelion seems well able to hold its own; for it probably derives more or less advantage from the recurved lobes, or teeth, which give the plant its name. These are admirably fitted to act in much the same manner as a ratchet; and when the neighboring grasses are blown against the dandelion, a blade may slide along the margin of the leaf toward the base; but, as it springs back from its own elasticity, it cannot slide in the opposite direction, for a tooth will catch it, and thus force it to help support the leaf, and hold it up to the sunshine. We need not stop to consider how the dandelion behavcs in soil which is neither very rich nor very poor, for enough has been said to show that it has not much to fear from any rivals it may meet under ordinary circumstances.

It is not only against the aggressions of neighboring plants, however, that our dandelion needs to be prepared: it is at least equally important for its welfare that it have some means of protection against herbivorous animals — not only such as might eat its leaves, but also the more stealthy ones that live upon the food which plants store underground. All such foes it thwarts by a means as simple as it is efficient. Every part of the plant contains a milky juice which is intensely bitter, and a first taste is quite enough to convince the most stupid animal that raw dandelion is not good eating, and most animals know enough to let it severely alone. Curiously enough, however, in this, as in many other cases, it happens that what in nature acts to deter animals from eating the plant, with man offers the chief attraction, for it is this very bitter principle (*taraxacin*) which

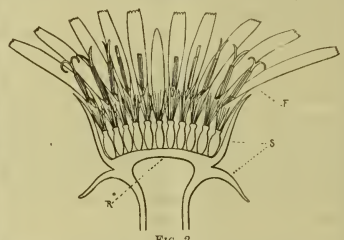

FIG. 2.

gives to dandelion greens their peculiar flavor, and affords the essential element in the extract which physicians prescribe.

The store of food, referred to above, which the dandelion accumulates in its root, not infrequently enables it to pass, almost unharmed, through dangers that with less provident plants would surely prove fatal. For example, it must often happen that from drought or from being trampled upon by auimals, the leaves become wholly or in part destroyed. Now, if there were no reserve store of food, the plant would have no chance of rallying; but as it is, this food supplies the material for new growth, and upon the return of favorable conditions, fresh leaves are developed, and the plant lives on as before. Primarily, of course, the purpose of this storage of food is to enable the plant to live on from year to year, resting in the winter, and in the spring beginning work again with a good start.

In comparing the higher with the lower plants, the superiority of the former is most beautifully shown in the better provision which is made for the welfare of offspring; and in this regard our dandelion stands among the highest. Before we can understand the ways in which our little plant performs this part of its life-work, we must briefly consider the structure of the blossom.

If with a sharp knife we cut a blossom in halves, from the stem upwards, the parts represented in Fig. 2 will be disclosed. Surmounting the stalk is a cushion-like receptacle (*R*), from the top of which arise a number of tiny flowers (*F*); while from the side grow out a series of green scales (*S*), forming an involucre around the whole. A single one of these florets (Fig. 3) exhibits the following parts: first, a bright-yellow corolla (*CO*), tubular below, but strap-shaped above, as if a tube had been split for part of the way on one side, and the upper part flattened; second, five stamens (*SN*), attached by slender filaments (*FM*) to the tubular part of the corolla, and with their anthers or pollen-sacs (*AN*) joined together by the edges to form a tube: third, a single pistil having a long style (*SY*), which, above, passes through the anther-tube, and bears at its end two diverging stigmas (*SG*), and below connects by a short neck (*N*) with the small ovary (*O*), which contains a solitary ovule; fourth, a calyx (*CX*) composed of numerous slender bristles.

FIG. 3.

The purpose of these complex structures is, of course, in one way or another to secure the development of the ovule into a seed fitted to produce a new plant. This development will proceed only after the ovule has been influenced (i.e., fertilized), by pollen placed upon the stigma; but when once the mysterious process of fertilization has taken place, then there follows immediately those wonderful changes in the blossom which culminate in the ripening of the fruit.

There are but two possible ways in which fertilization may be secured: either the pollen which affects the ovule must come from the same flower (then called close-fertilization), or the pollen must come from another flower of the same kind (cross-fertilization). Now, while either of these methods will insure the production of a seed, numerous experiments go to show that those offspring which result from cross-fertilization are in many ways superior to those which are produced from close-fertilization; and it is to the advantages of cross-fertilization that we have to look for an explanation of the significance of many peculiar structures, not only of the dandelion, but of flowers in general.

It is obvious, that, to secure cross-fertilization, there must be some agent to transfer the pollen from one plant to another. Most commonly, either the wind is taken advantage of for this purpose, as with elms, pines, grasses, etc., or else flying insects are induced to perform the office, as is the case with the majority of our familiar flowers. The wind is a very wasteful carrier, so that for every grain that is properly placed, thousands, or even millions, may be lost. Insects, on the contrary, waste but little; and, moreover, as Aristotle so shrewdly observed, they habitually confine their visits, for a number of trips, exclusively to the flowers of one species.

The dandelion seems to fully appreciate the great advantages of securing the services of insects, for it appeals most strongly to their love of bright colors and their passion for sweets. As the flowers open, each tiny golden cup is filled to the brim with purest nectar; and he must be a very dull insect, indeed, that cannot see the brilliant head of flowers as far as he can see any thing. At any rate, it is not the dandelion's fault if he does not, for the blossom is placed where it will be as conspicuous as possible. If the surrounding herbage is tall, the flower-stalk is elongated, so that the crown of flowers may not be obscured. If the plants around are low-lying, it would be wasteful to have a long stalk, so it has a short one, — sometimes so short that the blossom looks like a button in the centre of the leaf rosette. Economy of material is furthermore shown in the fact that the stalk is always hollow, — for it is a principle well

known to builders, that, when there is required a pillar of a given strength, less material is needed for the tubular form than for the solid cylinder.

But to return to our flower. We have next to consider how the visits of insects are utilized to secure cross-fertilization. If we examine the anther-tube of a flower that has just opened (Fig. 4), we shall see that the style has not yet protruded, but fills the entire cavity, except such space as is occupied by a quantity of pollen which the anthers have shed. So much of the style as is within the tube is thickly beset with hairs that point upwards; and when the lower portion elongates, this hairy part brushes the pollen out of the tube, and protrudes, covered with the yellow dust (Fig. 5). At this stage, an insect coming for nectar must rub against the style, and so become more or less covered with pollen. None of it, however, can get upon the stigmas, for they are not yet exposed. After a short time has elapsed, during which much of the pollen has probably been rubbed off, the style is seen to split at the top; and as the halves separate and roll back (Fig. 3), their inner faces (the stigmas) are exposed. If, now, the flower be visited by an insect which has previously been to a younger flower, the pollen he brings will be deposited upon the stigmas as he rubs against them, and cross-fertilization will be effected.

Fig. 4.

Fig. 5.

Let us suppose, however, that no insect visits the blossom, — and this must often happen to such as appear very early in the spring or late in the fall, when hardly any insects are around. In such cases we find that seeds are produced, and therefore we must infer that fertilization has in some way or other been secured. An examination of a flower still older than any we have considered (Fig. 6) will show us what takes place. Here it will be seen, that, after the stigmas have diverged, they continue to roll back, until a coil of one or more turns has been made; and as a result of this the stigmatic surface comes in contact with the hairs on the style, and touches the pollen grains entangled by them. Still, the close-fertilization thus accomplished is only a last resort, and it can only occur in the event of insects' visits having failed; for when pollen from another flower has once fallen on the stigma, no pollen coming afterwards can have the least effect. Thus, we have another instance of the dandelion's ability to make the best of its surroundings.

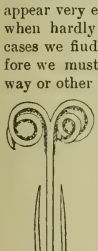
Fig. 6.

It even adapts itself to the weather; for when the sun shines, the scales of the involucre bend back, and the blossom is expanded to its fullest extent; but in dull weather, or at night, the scales bend inwards, and the blossom is tightly closed. The advantages of this remarkable movement, with its implied sensitiveness, is obvious when we consider that insects are abroad only in sunshine, while at other times there is danger of dew or rain getting into the nectar, and so spoiling it for the insects.

After fertilization has been accomplished throughout the blossom, the involucre closes, and remains closed during the ripening of the fruit. The changes which now take place are as follows: In each flower the corolla, stamens, and style, being of no further use, wither, and sever their connection with the ovary; the ovule develops into a seed containing a tiny plantlet well provided with food for its use during germination; the ovary grows to keep pace with the seed, its tissues become hardened, and a number of spine-like projections develop near the upper part; and finally the short neck which bears the calyx bristles elongates, pushing upwards the withered parts of the flower. At this stage the involucral scales bend back through an arc of about 180°, the cushion-like receptacle becomes almost spherically convex, the fruits radiate in all directions, the bristles spread, and a beautiful cluster of little parachutes is presented to the wind.

Even a glance at one of these fruits (Fig. 7) is sufficient to discover a wonderful fitness for transportation by wind, and more careful study shows that this fitness pervades every detail. For example, on examining the bristles microscopically (Fig. 8), it is shown that they are not simple threads, but each is hollow and has numerous projections extending on either side, all of which serves to increase the buoyancy in a very effective way.

The experience of aeronauts has shown that a highly important part in the equipment of a balloon, after the attainment of buoyancy, is the provision of some means of arresting the balloon's progress when the destination has been reached. One of the most successful means which they employ is the grappling hook; and as we find the base of our diminutive parachute provided with a number of upwardly directed spines, it seems fair to conclude that these serve to arrest the fruit upon favorable soil. If it comes to rest upon a smooth surface, — which, of course, would be barren, — the next breeze would easily blow it away; but if it chance to fall on soil or among other plants, the effect of the spines would be to retain it against the power of even a strong wind. Thus, we may leave it safely landed upon good soil, ready to begin, under favorable conditions, the cycle of its wonderful life.

Fig. 7.

Fig. 8.

[Original in *Popular Science News.*]

THE FRENCH ACADEMY OF SCIENCES.

M. E. Maindron, who has been during many years intrusted with important functions in the management of the Academy of Sciences, has recently given a good account of the history of this important scientific body; and we have deemed it of some interest to your readers to give an abstract of his book.[1]

Before 1666 the Academy was an unofficial society of scientific men, without any determined purpose, which assembled together, at fixed days, in the rooms of some of the members. It had no periodical paper. Among the members of this society were Descartes, the *Père* Mersenne, Pascal (Blaise and his father Étienne), Gassendi, etc. At the end of 1666 Louis XIV. and Colbert decided to allow this society to meet in the rooms of the Royal Library, and to raise some funds, which were used for pensions and experiments. No document exists showing how the members were to be elected nor how the Academy was to be managed. In 1666, among the members we find the names of Huyghens, Mariotte, Pecquet, Perrault, etc. For the first time a regular account is given of each assembly. The members met twice a week, Wednesday and Saturday, and were of two classes, — physicists and mathematicians; for the first time the society was called Académie des Sciences. Such were the beginnings of this scientific corporation, in commemoration of which a now well-known medal was engraved. Illustrious visitors attended occasionally its meetings. The visits of James II., king of England, and of Louis XIV., are recorded in the annals of 1690 and 1681. But at this period the organization of the Academy was quite of a provisional character; nothing had been decided concerning its management, the elections, and the purpose of the Academy. It is in 1699 only, that, on the order of the king, these questions were decided. In the charter of January, 1699, it is decided that the Academy shall consist of ten honorary members (physicists or mathematicians); twenty *pensionnaires* (three geometricians, three astronomers, three chemists, three anatomists, three botanists, three concerned with mechanical pursuits, one secretary, and one treasurer); twenty associates, fourteen national (two for each of the foregoing sciences), the eight others being chosen, if desirable, among distinguished foreigners; twenty *élèves*, or pupils, each of which was a sort of assistant to an associate, and engaged in the same pursuits. The elections were to be made in the following manner: the Academy to propose two or three names for each place, and the king to choose one. The members were, at the beginning of each year, to inform the Academy of the questions they intended to study. As a body, the Academy was to repeat all experiments communicated to her by the members or by strangers, and to give her opinion on the matter. At this time the more illustrious members of the Academy were Malebranche, Cassini, Méry, Tournefort, Fontenelle, Leibnitz, Lémery. The first meeting of the now regularly constituted Academy was held on April 29, 1699, in the Louvre palace, in new rooms which the king decided to set apart for the new society, with a library already well brought up, with a fine collection of scientific instruments and natural-history specimens. The Academy set to work with much zeal, and nothing particular is to be recorded till 1785, when a new rule was enforced. The Academy was divided in eight classes, — geometry, astronomy, mechanics, physics anatomy, chemistry and metallurgy, botany and agriculture, natural history and mineralogy. Each class was to consist of six members (three *pensionnaires* and three associates), nothing being changed concerning the secretary and treasurer, the twelve honorary, the twelve *associés libres*, and the eight foreign associates. At this time the more illustrious members were Lalande, Laplace, Cassini, Daubenton, Lavoisier, Berthollet, Vicq-d'Azyr, Fourcroy, Adauson, De Jussien, Lamarck, Haüy, Bernouilli, Franklin, Euler, Priestley, Hunter; the five last named, in the class of foreign associates. In 1793 (8th of August) the revolutionary government decided to suppress the Academy of Sciences: —

"Art. I. — All academies and literary societies patented and paid by the nation are suppressed." The 10th of the same month, Lavoisier wrote to Lakanal, president of the Committee on Public In-

[1] *L'Académie des Sciences*, vol. iii. 8vo, 339 pages, with 61 pictures, autographs, portraits, etc. Paris: Alcan, 1888.

struction, to inform him that the members of the Academy had organized a club, a free society, which proposed to continue the Academy's work till the Government had come to a decision concerning its future. Lakanal approved of the plan, and allowed the meeting to be held in the rooms of the Academy; but three days later the rooms were shut. The Academy of Sciences was entirely suppressed.

Two years later, Bonaparte, then First Consul, reorganized the Academy somewhat after Colbert's original but unexecuted plan. The different academies were incorporated in a single body, the Institute of France. The Academy of Sciences remained as it was, in itself. The meetings were held in the same rooms; the old members kept their places and titles: but in 1801 the rooms of the Louvre were deemed insufficient, and Bonaparte decided to secure new lodgings for the Institute. The *Palais des Quatre Nations* was chosen: it is the present seat of the Institute, where the different academies meet turn in turn in different rooms. That of the Academy of Sciences is a large one; rather dark, it must be said, but well furnished and decorated. Up to 1875 it was lighted by candles: gas has been used only since that time. It was in 1879 that electric bells were for the first time used in this temple of science. As to telephones, no one thinks of them yet. This state of things is rather ludicrous, and is well calculated to excite the hilarity of outsiders, as it does in fact. The members of the Academy of Sciences have been paid a small sum from the beginning. Louis XIV. had pensioned many of them, but the sums paid to each were not the same. At present each member receives three hundred dollars per year: this sum was decided by Carnot, the grandfather of the present President of the French Republic, who was at that time (1796) president of the *Directoire*.

Although the different academies are of ancient date, the Institute, which is the body consisting of the five academies incorporated together, is one of Bonaparte's creations. Bonaparte himself was a member of the Academy of Sciences. He was elected (1797) in the class of mechanics, in the place of Carnot, who had been obliged to take a refuge in foreign parts. It was also Bonaparte who decided the uniform which is at present worn by the members of the Institute in different official circumstances; who proposed to award a gold medal to Volta, after reading his memoir on galvanism and the galvanic fluid. He resigned his office in 1817, and his place had been occupied since by Molard, Combes, Tresca; and Maral Desprez is the present holder of this illustrious chair.

We have not been able to condense in so short a space many very interesting facts concerning the history of this enlightened and illustrious scientific corporation, but the principal dates of its history have been recalled. Readers who are anxious to know more should refer to M. Maindron's excellent work, in which all the necessary documents have been collected. H.

THE DIFFRACTION OF SOUND.

AT a recent meeting of the Royal Institution a lecture was delivered upon "The Diffraction of Sound," by Lord Rayleigh. The lecturer said that his subject had been furnished by the close analogy existing between light and sound, both of which are transmitted by undulatory vibrations. He then proceeded to prove, by a series of delicate experiments, that "sound-shadows" exist as well as the shadow produced by light, although under ordinary conditions they are not sufficiently sharp and distinct to be very noticeable. This disagreement, it was pointed out, is due to the great difference existing between the comparative wave-lengths of light and sound. Thus, in air the wave-length of "middle C" in the musical scale is about four feet, whilst the ray in the middle of the spectrum has a wave-length of only one-forty-thousandth of an inch, a proportion of about 1 to 2,000,000. Under favorable conditions, however, "sound-shadows" are much more definite than might be supposed. In his experiments the lecturer chose as his source of sound a note extremely high on the musical scale, — so high, indeed, as to be quite inaudible to the human ear. Since the mechanism of the ear would not, therefore, be sufficiently sensitive to distinguish between the presence or absence of this sound, a more delicate test had to be devised. This difficulty was overcome by the lecturer through the introduction of a "sensitive flame."

This flame was described as consisting of a jet of gas driven at a great pressure through a minute orifice; the pressure being so regulated, that the flame, although burning quietly and steadily under normal conditions, immediately began to flare upon the interference caused by the vibratory motion communicated to the atmosphere by the sound. Under these conditions, even when the "sensitive flame" and the source of sound were some twelve feet apart, the lecturer was able to cause the flame to burn quietly or to flare by the mere respective introduction or withdrawal of his hand at any position between the flame and the source of sound.

A further phase of this phenomenon was rendered apparent when an obstruction, however slight, was placed behind the flame, so as to reflect the sound back along the path it had travelled. The lecturer obtained by this means what he terms "stationary waves," or waves of sound which have stationary "nodes;" and "loops," that is, zones at which a minimum or maximum amount of vibratory movement respectively occur. By altering the distance between the reflector and the "sensitive flame," he showed that flarings of the flame, when it coincided in position with the "loops," were contrasted with quiet periods when "nodes" were reached. Since the distance between a "node" and a "loop" must evidently be equal to half the wave-length of the note producing the disturbance, Lord Rayleigh pointed out that the pitch of the note could easily be calculated by using a reflector made to slide along a scale. In this way he ascertained the note he had employed in his experiments to possess a wave-length of half an inch, and therefore to be between six and seven octaves above "middle C." Further, he remarked, that, as the "nodes" occur at the place of minimum disturbance, it follows that their distance from the source must be an even multiple of the wave-length of the note; on the contrary, the position of the "loops" would be furnished by an odd multiple of the wave-length.

Attention was then drawn to another remarkable property of the "sensitive flame," — that although the sound caused the flame, when placed in a certain position, to flare, no effect was produced when the flame was revolved on its own axis, so as to be at right angles to its former position. But the flaring could be produced when in this position by diverting the sound in a direction making an acute angle with its former course, and then reflecting it from a plane surface so that it reached the flame at the same point as before its position was altered. In this experiment, also, the lecturer showed the existence of cycles of "nodes" and "loops" by successively advancing and withdrawing the reflector to and from the "sensitive flame," although maintaining the same relative position with the source of sound. The concluding experiment was still more interesting, in affording additional proof of the correctness of the principles enunciated by Huygens respecting the undulatory transmission of light. The lecturer directed the wave of sound through an aperture about two feet wide, and so adjusted the flame as to barely flare with the disturbance. He then showed, that by placing an obstacle so as to occupy either the space in the centre half of the aperture, or the area of the encircling external half, in both cases the intensity of the effect was increased to such an extent as to cause the flame to flare vigorously. The lecturer proved, by reasoning analogous to that employed in Huygens's *Zones*, that this phenomenon was due to the "pencil" of sound being made up of concentric rings of equal but opposite vibratory intensity, producing in combination a nearly neutral effect upon the flame. By interception of the centre rings, the passage of the outer rings would produce a greater aggregate effect upon the "sensitive flame," since they would contain a preponderance of one motion; whilst the same effect would be produced by the reversal of the conditions, since a preponderance of the other motion would then exist. In conclusion, Lord Rayleigh pointed out the analogy existing between this theory and that demonstrated by Fresnel regarding the formation of a bright spot in the shadow produced by the interception of the middle rays of a "pencil" of light in a similar manner. — *London Pharmaceutical Journal.*

SCIENTIFIC BREVITIES.

ONE pound of mercury converted into fulminate is sufficient to charge fifty thousand percussion caps.

IN London recently an egg of the extinct great auk (*Alca impennis*) was sold for two hundred and twenty pounds. It belonged to the collection of Mrs. Wise, whose husband bought it of a dealer in Oxford Street in 1851 for eighteen pounds. It was originally brought to England from Paris, and is now said to have been bought for America.

PREHISTORIC ALTARS. — There has recently been discovered in the high Alps, near the summit of the great St. Bernard, five large granite altars and numerous other relics of the stone age, used in pagan epochs for sacrifices. Swiss scientists consider this discovery a proof that Mount St. Bernard was a place of sacrifice in pagan times, and that the canton of Valais must have been inhabited by human beings as far back as the stone age.

THE ANCIENT GREEKS. — Professor Trent of Johns Hopkins University, lecturing to Baltimore workingmen, has been impressing the fact that there is nothing new under the sun. There were tenement-houses, he says, in ancient Athens, with many families in one house; there were corners in the iron market and in the olive-oil industry then, manipulated just as are Wall-street corners now; and there were slave-insurance offices, where the old Greek, for about one dollar a year, could be insured against his slaves running away.

DYNAMITE is so instantaneous in its action, that a green leaf can be compressed into the hardest steel before it has time to flatten. One of the experiments at the United States Torpedo Works was to place some leaves between two heavy flat pieces of iron, set them on a firm foundation, and see what gun-cotton would do in forcing the iron pieces together. A charge was placed upon them by compressing the gun-cotton into a cylindrical form about one inch thick and three or four inches in diameter, through the centre of which a hole is made for a cap of fulminate of mercury, by which the gun-cotton is exploded. The reaction was so great, from merely being exploded in the open air, that one of the iron pieces was driven down upon the other quick enough to catch an impression of the leaves before they could escape.

Practical Chemistry and the Arts.

GLASS AND PORCELAIN PAINTING.

The manufacture of both glass and pottery dates back to prehistoric times, and we have no knowledge of either the first glass-maker or potter. Whoever these individuals may have been, they could not have practised their art very long before noticing that certain impurities in their materials gave a more or less brilliant color to the finished product. In time they doubtless learned to recognize and select the earths which produced the highly prized hues, and from this rude beginning the modern art of vitreous ornamentation has arisen.

The principle of both glass and porcelain painting are the same, and only vary in the practical details. Porcelain-painting is really glass-painting, as the colors are usually melted into the glaze or film of glass which covers it, or else the colors themselves are mixed with materials which form a glaze when melted.

It has been found, that, when certain metallic oxides are melted into glass, they unite with it, forming metallic silicates or analogous salts, which in many cases show the greatest beauty and brilliancy of color. It is a very pretty experiment to melt a little borax in a crucible, and, after it has cooled, it will be perfectly transparent and colorless; then add a minute quantity of some salt of cobalt, and fuse again, when the whole will become of a magnificent blue color. Other substances give different tints: thus, oxide of iron can give red, brown, violet, and yellow; chromium gives a beautiful green; manganese, violet, brown, and black; antimony and lead, yellow; copper, green and red; silver, red and yellow; gold, a beautiful ruby red. Platinum and iridium give a fine black, and gilding or silvering is accomplished by melting the metals themselves into the glaze. Certain salts of gold also have the property of reducing to the metallic state in the firing, producing a very brilliant gilding. These different colors are so characteristic that a system of chemical analysis has been founded upon them, and the chemist can often save himself much time and labor by noting the color of a borax "bead" in which a little of the substance under examination has been melted.

The actual preparation of colors for porcelain-painters is a much more difficult matter than the above facts would seem to imply. Much experiment is necessary to obtain all the different shades and intermediate tones. Unlike oil paints, the method of simple mixing cannot be followed. A mixture of blue and yellow in mineral colors, for instance, may give, after firing, any thing but the green tint which a similar mixture of oil or water-colors would produce. Such points can only be determined by actual trial.

The composition of many of the most beautiful colors is kept a carefully guarded secret by the manufacturers possessing the recipe. The dark-blue tint of Dresden porcelain was for a long time such a secret, and may still be so, although a few years ago we were informed at the Meissen Pottery that it was simply cobalt. Other unknown ingredients may, however, be added to it. The softness and delicacy of a fine painting on porcelain or glass cannot be surpassed by any work in oil or water-color, and it possesses the additional advantage of being indelible and unchangeable by those natural agencies which will in time destroy the more perishable paintings on paper and canvas.

NEW METHODS IN ANALYSIS.

In a former article a description of a new process for the separation of iron from nickel was given, depending upon the formation of ferro- and nickelo-cyanide of potassium, and of their different reactions with bromine. Since then, however, the process has been modified and altered without affecting the accuracy of the results, so as to avoid the use of phosphoric acid, the presence of which might complicate matters, and at the same time to admit of its application to other separations.

Nickel from Iron. — To the cold concentrated (twenty to thirty cubic centimeters) and slightly acid solution add an excess of solid sodic hydrocarbonate, in such quantity, that, after stirring, a little remains undissolved, and nickel and iron both appear to be thrown down. Now add potassic cyanide until the precipitate dissolves, then heat gently until the pale-yellow color of the ferrocyanide is produced; at this stage the solution should be perfectly clear and free from any ferric hydroxide. Allow the liquid to cool; add a considerable quantity of a rather strong solution of potassic hydrate; then treat with chlorine, continuing the current of the gas until the green nickelous hydrate is completely converted into the nickelic hydrate, and becomes perfectly black, after which it may be filtered off, and treated in the usual manner for electrolytic deposition.

Alumina from Iron, Nickel, or Cobalt. — Proceed exactly as above, and add a few drops of potassic hydrate to the somewhat turbid yellow solution until it becomes perfectly clear; then boil with the addition of ammonic chloride, when the alumina will be precipitated free from any of the other accompanying metals. The potassic hydrate and cyanide, as well as the sodic hydrocarbonate for this separation, should be tested for alumina and silica, — impurities almost invariably present.

Manganese from Iron, Nickel, or Cobalt. — Add excess of sodic hydrocarbonate and potassic cyanide, as already directed, and warm gently until the solution — which in presence of manganese has a dirty blue-green color — becomes pale yellow and quite clear; then allow to cool, add a little potassic hydrate, and precipitate the manganese as peroxide by adding a little peroxide of hydrogen, and leaving the solution in a warm place for a few hours. The peroxide, as is usual when precipitated from alkaline solutions, contains alkali, from which it is very difficult to free it by washing; so that it is best to dissolve in hydric chloride, and precipitate as carbonate with ammonic carbonate. In order to avoid this inconvenience, the cyanide solution may be precipitated by sulphuretted hydrogen, when manganese sulphide is rapidly and completely thrown down, and admits of being easily washed free from impurities.

Iron from Zinc. — Procure a solution of the cyanides as above, and boil the clear solution with an excess of colorless ammonic sulphide until the steam is neutral to test-papers. The zinc is wholly precipitated as sulphide quite free from iron (or nickel and cobalt if present), and in a granular condition, which may be filtered and washed with the utmost ease.

The presence of cyanates or carbonates in the potassic cyanide exerts no influence whatever on the above separations. — Thomas Moore, *in Chemical News.*

LIQUID AMALGAM.

An interesting account of a series of experiments upon the so-called alloy between the metals sodium and potassium is given by M. Joannis in the current number of the *Annales de Chimie et Physique.* For some years it has been known, that, although in many respects so similar, these two metals possess a certain affinity for each other, and unite under suitable circumstances to form a liquid amalgam-like substance. M. Joannis has at length shown that a definite compound, NaK_2, is formed, with considerable evolution of heat, when the fused metals are brought together in the right proportion. In order to prove this fact, thermo-chemical methods were resorted to; liquid mixtures of the composition Na_2K, NaK, NaK_2, and NaK_3 being successively introduced into the calorimeter.

The hydrogen liberated by decomposition of the water in the calorimeter was caused to pass first through a perforated platinum plate, and afterward through a long, thin-walled glass spiral, eventually escaping in minute bubbles through the water itself, after becoming reduced to the temperature of the calorimeter. The liquid mixture of metals was gradually introduced by means of an ingenious apparatus consisting of a drawn-out delivery tube containing the alloy between two layers of protecting naphtha, and which, by means of a valve, could be placed in communication with a reservoir of compressed air, so that, by regulating the valve, a gentle stream of the liquid could be forced out as required. When the calorimetrical experiments were concluded, the amount of alkali was determined in an aliquot part of the water in the calorimeter, and thus the amount of metal used could be arrived at.

From the data afforded by these experiments, M. Joannis appears to have conclusively shown that the only stable compound is NaK_2, all others being mixtures of this, with excess of one or other of the two metals. It is very satisfactory that a reliable method has at last been found of distinguishing between true compounds and physical mixtures of metals, and rather remarkable that one of the earlier analyses of the most stable combination of sodium and potassium gave as the percentage of potassium 76.5, a number which closely approximates to that required for NaK_2. — *Nature.*

SURFACE CONDENSATION OF GLASS.

Among the investigations on this point is that of Bunsen. A bundle of glass threads, the total surface of which was determined by preliminary observations and calculations, was enclosed in a chamber connected with a long tube, the lower end of which was dipped in mercury. The gradual rise of the mercurial column showed that an apparent absorption of carbonic acid by the glass was still going on at the end of three years. Later observations proved that, although the glass had been carefully dried, it is impossible to get rid of all the adhering moisture, unless the temperature is raised to a point not far short of the critical temperature of water. If this precaution has been omitted, carbonic acid, if present, will, according to Bunsen, be dissolved in the water-film; and since the inner layers of the liquid are subjected by molecular attraction to a pressure which is measured by hundreds of atmospheres, they are capable of absorbing enormous quantities of the

gas The strong acid thus formed appears to attack the glass, and it was found that nearly six per cent of the total mass of glass threads employed had been disintegrated. The long-continued apparent condensation was therefore really slow chemical action. Nay, more: when the glass had been dried at a high temperature, no appreciable condensations of carbonic acid on the surface took place in eight days. A small quantity of water was then introduced, and absorbed by the glass threads with a rapidity which showed that when really dry they acted as a more powerful desiccator than calcium chloride. Immediately after the introduction of the water, the absorption of the CO_2 began as before, which proved that moisture was necessary to produce the phenomenon, or that carbonic acid does not condense to a measurable amount on dry glass.— *Chemical News.*

CHLORIDE OF NITROGEN.

A striking new experiment, exhibiting the terribly explosive nature of chloride of nitrogen, is described by Professor Victor Meyer. A few drops of the yellow chloride were prepared in the usual manner, — by inverting an exceptionally thin flask filled with chlorine gas in a leaden dish containing a solution of ammonium chloride. Instead, however, of gently agitating the apparatus so as to cause the drops to fall into a smaller leaden capsule placed beneath the mouth of the flask, they were allowed to float freely upon the surface The whole apparatus was then enclosed in a cover-box fitted with stout plate-glass sides, through the top of which was passed a bent pipette, turning up below just under the mouth of the flask, and connected outside with a dropping funnel containing chloride of ammonium solution and a few drops of turpentine. When sufficient chloride of nitrogen had collected, the tap of the funnel was carefully turned so as to allow a little turpentine to slowly rise in the flask. After a moment or two it reached the surface, and mingled with the chloride of nitrogen, causing a brilliant flash of light and a loud explosion, which Professor Meyer likens to a thunder-clap, so much more powerful is the detonation in a confined space. The flask, of course, was shattered, not into powder, but into tolerably large fragments: the plate-glass box, however, even after many repetitions of the experiment, remained intact; a small door on the side away from the observers having been left ajar so as to prevent any notable increase of pressure. Curiously, the chloride of nitrogen never entirely exploded; a part remained in the disorted leaden dish, and maintained an incessant fusillade for more than a minute.— *Nature.*

ASBESTOS FOR FILTRATION.

W. Fresenius reports that he has found finely picked asbestos to be the best medium for facilitating the filtration of viscid liquids. He found it especially valuable in filtering solutions of peptonized liquids, such as are produced by the action of any of the digestive ferments, and which it is next to impossible otherwise to filter through paper.

He states that he had previously made use of this useful property of finely divided asbestos when he was occupied with the determination of the water-soluble portion of a very fine flour used as infants' food. It had been impossible to obtain a clear filtrate until asbestos was tried, when there was no difficulty whatever.

He states that he has recently succeeded in accomplishing the filtration of similar liquids by diluting with a considerable proportion of water, and then incorporating with the mixture a small quantity of previously ignited finely picked asbestos, and thoroughly shaking. After about twelve hours all suspended matters will have deposited, and the liquid may be easily removed by means of a siphon. The operation of washing and shaking is repeated once or twice with fresh water, and the whole mixture finally passed through a glass funnel, the neck of which contains a pellet of asbestos. If the first portion of the filtrate runs off cloudy, it is poured back until it is clear. Fresenius states that he allowed the residue in the funnel to become tolerably dry, after which he removed it for the purpose of determining the amount of nitrogen by Kjeldahl's method. Any matter adhering to the funnel can easily be wiped off by means of a small pellet of asbestos, and added to the rest. — *Druggists' Circular.*

A SUBSTITUTE FOR HYDRAULIC CEMENT.

According to a statement of Mr. Miles, a well-known engineer, it is a fact peculiar to Spanish countries that ordinary brick-dust, made from hard-burned, finely pulverized bricks, and mixed with common lime and sand, is universally and successfully employed as a substitute for hydraulic cement. Mr. Miles says, that, during an engineering experience of some six years in Cuba, his opportunities were ample for testing its merits; and he found it in all respects superior to the best Rosendale hydraulic cement for culverts, drains, tanks, or cisterns, and even for roofs. In an experiment to test the strength of this product, it was found that a block of it half an inch in thickness, without sand, and after immersion in water for four months, bore, without crushing, crumbling, or splitting, a pressure of fifteen pounds per square inch. It is thought that by the addition of pulverizing mills to brick-yards, to utilize the waste and broken bricks, a profitable manufacture might be carried on. — *Light, Heat, and Power.*

[Original in *Popular Science News.*]

A TEST FOR SACCHARIN.

BY L. D. KASTENBINE, M.D.

As saccharin may be used to adulterate sugar. a method of separating and identifying may not prove uninteresting to some of your readers.

Being a sulphur compound, and soluble in ether, the writer employed the method suggested by H. Reischauer, and finds it the best in actual practice. All that is necessary is, to treat the sugar with about three times its volume of ether in a closed vessel for twelve hours, with frequent agitations. The etherial solution is drawn off and evaporated, and the residue *carefully* ignited in a crucible with carbonate and nitrate of sodium, whereby the saccharin will be converted into sulphate of sodium, and can be estimated as barium sulphate. Care must be used in igniting, as explosions occur from too intense heat.

PRACTICAL RECIPES.

Fixing Indian Ink. — Indian ink, as most of our readers know, is composed of the finest ivory-black and a gelatine size, and is excellent for plans and drawing until any color "wash" — or even a little dampness — comes near the lines, when they then either "blur" or "run" altogether. This may be prevented by dissolving in the water used for rubbing up the ink with, about eight grains of bichromate of potassium, or six and a half of the corresponding ammonium salt per fluid ounce.

Red Stains for Leather. — (1) Dissolve one ounce cochineal in half-pint of hot water, and add one gill of spirits of hartshorn. (2) *Bright Crimson* is prepared from alum or tin salts and a decoction of cochineal. (3) *Scarlet.* — Scarlet berries (bruised), 1.05 ounces, dissolve in 4.2 ounces alcohol, eighty per cent strong, and filter. (4) *Red.* — Shavings of red Brazil-wood are placed in a bottle, 2.2 pounds wine vinegar is poured over them, and digested for eight days, and stirred frequently in the mean while. The solution is then filtered through a cloth. Meantime a solution of 1.05 ounces alum, free from iron, in 8.75 ounces water, is prepared, and the above preparation of Brazil-wood is added to this under constant stirring. A very beautiful red is obtained in this manner. The shavings of Brazil-wood may also be boiled in rain-water, and this to be compounded with a solution of bitartrate of potash.

To take Impressions from Seals. — To take an exact model of any coin, medal, embossed stamped paper, or, in fact, any device raised or imprinted, cut a piece of cardboard, with which form a ring just the dimensions of the impression to be taken, then pour within the said ring melted fusible metal. The carding will prevent the metal from running away, and in a few minutes it will cool, and the impression taken will be the same as the original, but reversed. Fusible metal is a compound of eight parts of bismuth, five of lead, and three of tin, which liquefies at the same temperature as boiling water.

RAILROAD NOTES.

A New Boiler Covering. — At the Rhode Island Locomotive Works a number of new engines are being built that are lagged all over boiler and dome with an asbestos mortar that is easily applied, and makes the job all one piece. The preparation is put on while the boiler is under steam, and a couple of days are needed to apply it properly. It is claimed that it is not necessary to remove it when the engine goes into the shop, as the least leak is shown through it, and a piece can be cut out, the leak repaired, and replastered. It cannot fail, says an exchange, to be a better job than wood, and is fire-proof.

Parchment Bearings. — Experiments are being made on Prussian railways with axle boxes fitted with bearings of vegetable parchment in place of brass. The parchment is strongly compressed before being used; and it is thoroughly dried, to prevent subsequent shrinkage. Wooden rings are placed on the outside of the bearings, fitting the collars of the journal. An emulsion of water and oil, and all the mineral oils, are used as lubricants. The parchment soon becomes impregnated with oil, and is able to go a long time without a renewal of lubrication. It is between the body of the journal and the thin edge of the parchment segments that friction takes place. The claim is made that these compressed paper bearings make a tough material that is superior to metal. Such bearings are also in use in a German sawmill with satisfactory operation.

Railway to Teheran. — Accounts received from the Caspian describe the railway from Resht to Teheran as being already in hand, the engineers being on the spot, and material commencing to arrive from Europe *via* Batoum and the Trans-Caucasian Railway. The line is being constructed by a Belgian syndicate, enjoying the warm support of the Russian Government. It is expected that the undertaking will be rapidly completed, the Shah as well as the Russian authorities being impatient in this respect. At present it is not contemplated to push the line any farther ahead; but plans exist for extending it eastward to Meshed and south to the Persian Gulf. As regards the former, it is proposed afterwards to carry it on to Herat and India. This, when the section from Baku to Resht, is also finished, will open a new route to India from the Black Sea.

Home, Farm, and Garden.

THE CHEMISTRY OF THE DAIRY.

Milk, the most important of all dairy products, is in many respects a perfect food, inasmuch as it contains representatives of all the substances which go to make up the animal frame. It is principally composed of water, butter, milk-sugar, casein, and soluble and insoluble inorganic salts. The amount of the principal constituent, water, is very variable, even from legitimate causes, but may be said to average from eighty-five to ninety per cent.

Although to the unaided eye milk appears to be a homogeneous white fluid, the microscope shows it to consist of a clear liquid, in which are suspended numerous globules, which make it opaque. These globules consist of milk-fat, or butter, and each one is surrounded by a very thin covering, or membrane. When they are violently agitated, as in churning, these membranes are broken, and the globules of butter cohere together into larger masses. The formation of the butter is, to some extent, dependent on the temperature; and in old times, when the butter resolutely refused to "come," the trouble was laid to the witches, and a red-hot horseshoe was dropped into the churn, which served the double purpose of frightening away the witches and heating the cream.

Cream is the lighter portion of the milk, which rises to the surface upon standing. It contains a large proportion of the fatty matter, and is collected and saved for churning. The buttermilk remaining after churning contains about one-fourth of the fatty matter.

Pure butter is principally a mixture of two fats, known as margarin and olein, with smaller quantities of butyrin, caproin, and caprin. These fats are all analogous to each other, margarin having the symbol $C_{54}H_{104}O_6$. It is a compound of margaric acid and glycerine, and the margaric acid in turn is probably a mixture of stearic and palmitic acids. These fats are practically identical with those formed in the body of the animal, from which the well-known butter substitute, oleomargarine, is made. The principal chemical difference between the two articles is the lack of the butyrin, caproin, etc., in the artificial product; but, as far as healthfulness is concerned, one is as good as the other. In fact, a good article of oleomargarine is preferable to the poorer grades of butter.

Fresh milk, when chemically tested, is found to be slightly alkaline, and this alkali serves to hold in solution a very important substance called casein, which is the basis of cheese. If a little vinegar or other weak acid is added to milk, this substance separates out in the form of curd. The insoluble pellicle which forms on the surface of boiling milk is due to this substance. When milk sours naturally, lactic acid is formed, which neutralizes the alkali, and the casein separates. It also has the peculiar property of being precipitated by the action of rennet, or the mucous membrane of the stomach of the calf. In this case no acid is formed; but the action seems to depend upon the presence of bacteria, or microscopic organisms, in the rennet. If the milk is warmed, it separates more readily; hence when milk that has very slightly soured is added to hot tea or coffee, it "feathers" from the separation of the casein.

Chemically, casein resembles albumen, containing less sulphur than that substance. A substance known as legumin, or vegetable casein, is found in peas and beans, which closely resembles that of milk, and is coagulated by rennet in the same way. If, after churning, the casein contained in the buttermilk is not thoroughly removed from the butter, it will induce a fermentation or decomposition, resulting in the production of certain volatile and offensive acids, and the butter becomes rancid.

In the manufacture of cheese the casein is coagulated by rennet, pressed into the desired shape, and allowed to stand and "ripen." The ripening process is a fermentation analogous to that produced in rancid butter, and the powerful odor of certain cheeses is due to the same volatile acids. It is only a matter of habit which makes the flavor of cheese agreeable to some persons, while that of rancid butter is repulsive to every one. Some semi-civilized nations, more consistent than ourselves, will only eat butter when sufficiently "high," considering the fresh article tasteless and insipid.

The different kinds of cheeses are dependent upon the kind of milk used in their preparation, the richer ones being made from milk containing a larger proportion of cream. Stilton cheese is made from a mixture of new milk and cream, Cheddar from new milk alone, Cheshire from milk from which about one-eighth of the cream has been removed, and Dutch cheese from skimmed milk only.

The other constituents of milk are of minor importance. Milk-sugar is used, to a limited extent, in medicine; and the inorganic salts, which consist principally of phosphates and chlorides of potash, soda, lime, magnesia, and iron, are only valuable as increasing its value as a food. From the earliest times milk and its products have been recognized as the best possible substances for the nourishment of the human body; and the results of modern chemical analysis confirm this belief, and show that they are most perfectly designed to produce health, strength, and flesh.

[Original in *Popular Science News.*]

PEAT.

BY W. J. CHASE.

Most readers of the *Popular Science News*, in common with the majority of people, doubtless have a very indistinct notion of what peat is. They probably have, in connection with their reading and study of Ireland, often come across the name. Indeed, it is as the fuel of the Irish peasantry that peat is best known to American readers. But peat-bogs are by no means peculiar to Ireland or to any one country, being found in all cold countries, yet rarely met with nearer the equator than in the temperate zones.

Peat is vegetation partially decomposed under water, and the process of its formation is constantly going on all through New England and the northern part of the United States. Almost every fresh-water swamp contains it; often, however, so mixed with sand as to be hardly recognizable.

There are many different kinds. The two most common in the United States are the black and the red. The black, called also grass-peat, is formed of partially decomposed grasses, and is of very little value, as it possesses no fibre, and crumbles to pieces in the drying. The red, moss, or wood peat, — for it is known by any of these names, — is perhaps not quite so common as the grass-peat, yet it is found in great abundance. It is formed, as its names suggest, of decomposed moss, swamp herbs, and small shrubs. It is this variety of peat which forms the basis of several already large and growing industries.

Moss-peat varies in color and quality with the depth from which it is taken. At the surface it is red, and gradually shades in color to a light brown, then darker, until finally, at the depth of fifteen or twenty feet, it is so dark a brown as to be almost black. It is not at all uncommon to find deposits of peat thirty feet, and even more, in depth. At these lowest depths it is much more compact, and has an oily, resinous look. In the language of the peat-digger, it is "fat" peat.

One of the chief characteristics of moss-peat is its fibre, the existence of which it is hard to explain. It is this fibre which makes it possible to cut it into blocks when wet, which retain the same form when dried. On account of this fibre, too, the dried blocks can be handled and sawed like wood.

A peat-bed which is being worked, with its regular system of main and cross ditches for draining, presents at a little distance the appearance of a huge cake of chocolate cut up into small squares.

Peat, without other preparation than that of drying in the sun, has been used as a fuel for more than a century and a half in New England even. But the process of sun-drying a block of wet peat, nine-tenths of which, by weight, is water, is too long, and the fuel when thus prepared is too bulky, to be of much practical value. To overcome this, there are at present several processes. On the shores of Lake Superior, where other fuel is scarce, the peat, taken full of water from the bog, is exposed to great pressure, which squeezes out the water, and compresses the block into a much smaller bulk.

By another process the block of peat, when thoroughly dried by artificial heat, is dipped into a bath of petroleum oil, where it is allowed to remain until it has absorbed like a sponge a certain quantity of the fluid. After draining for a few minutes, it is then dipped into a bath of liquid resin, from which it emerges encased in an air-tight covering of the hardened resin.

Besides its uses as a fuel, peat also is valuable as a fertilizer, both for the ammonia it contains and also for the absorbing properties it possesses; and finally, the mossy top layer of the peat-bog is of considerable value as a stall-bedding for horses and cattle.

THE BIRD-FOOT VIOLET.

The bird-foot violet, *Viola Pedata*, is the largest and most conspicuous of our native violets. Unlike most of the species, it grows in sandy soil, and likes dry, sunny places. It is really a flower of the woods, growing on their edges, in sandy roads, and on hillsides in the vicinity of woods. It is always associated in my mind with the white birch, for it is in full blossom at about the time when these trees have just come out in their bright, straight-veined, taper-pointed leaves: and wherever I have found them, there were always birches close

by, or springing up among them. In the large flowers, which are about an inch broad, there is a charming variety, both in form and color. In some the petals are broad, in others they are narrow; and the color varies from deep purple and blue to pale lavender, even to white. I once found two or three clusters with light and dark pink flowers, and in the same place with these there were many with a reddish tint. On the hill where these grew, a crop of grain had been raised the previous year, and it was delightful to see how luxuriantly the bird-foot violets were growing and profiting by the increased richness of the soil. The whole hilltop was covered with great tufts of them, with unusually large leaves and flowers, and very long leaf and flower stalks. The pink variety I transplanted to the garden, where it has grown and retained the pink color of the flowers, blossoming at intervals all through the season. The purple ones, which I have cultivated, make a beautiful mass of color in the garden, the flowers growing

close together. Nature always gives to each flower a leaf of just the right shape and shade of green that its color and characteristics need, and the bird-foot violet has been favored with a very pretty, delicate one, palmately divided and cut, and suggesting a bird's foot in its form. It is one of the stemless violets, the leaf and flower stalks all arising from the short, thick root-stalk. There is an occasional variety (var. bicolor) which Gray describes as "very handsome, with the two upper petals deep violet, and, as it were, velvety, like a pansy." Under cultivation, who can tell what new attractions this wild flower might develop?—ROSA B. WATSON, *in Vick's Magazine.*

WHAT FLOWERS WILL GROW IN THE SHADE?

THE question, "What flowers will grow in the shade?" is put to me every spring by scores of city people whose little garden, which they wish to devote to flowers, is so walled up by neighboring houses, that the direct rays of the sun never touch it. But few plants will develop their flowers there, and none will do it so well as if it were lighted up by sunshine a part of the day. Fuchsias, pansies, forget-me-nots, violets, lobelias, lily of the valley, hollyhocks, phloxes, and other herbaceous plants whose native habitat is a shady wood, will do best; but even these languish if denied all direct sunlight. The best effect in such situations is produced by ornamental-leaved plants, the beauty of which is not dependent upon their flowers. Among these may be ranked the gold and silver variegated-leaved geraniums, achyranthes, alternantheras, begonias, caladiums, centaureas, coleuses, etc., which, if planted so as to bring the various shades in contrast, produce a pleasing effect, which continues during the entire summer months, and is not surpassed by any display of flowers. The cultivators of flowers in rooms should understand the necessity of sunlight to plants that are to flower, and endeavor to get these as close as possible to a window having an eastern or southern aspect. The higher the temperature, the more plants suffer from want of light. Many plants might remain semi-dormant in a temperature of forty degrees, — in a cellar, for example, — away from direct light, for months, without material injury; while if the cellar contained a furnace keeping a temperature of seventy degrees, they would all die; such would particularly be the case with plants of a half-hardy nature, such as monthly roses, carnations, fuchsias, geraniums, etc. In our greenhouse culture of flowers, direct sunlight is an all-important consideration; and a spell of sunless weather in midwinter is often a loss to us of hundreds of pounds, by preventing the development of flowers. Hence we use every means at command to dispose the plants to secure the greatest amount of light. The debilitating effects of want of direct light on plants are well illustrated by taking a vigorous plant in full foliage and flower, that has been growing in the direct light of our greenhouse benches, and placing it under the bench. If the temperature is high, — say, seventy degrees, — in forty-eight hours the sickly signs, showing want of light, will be apparent to an experienced eye; in a week its condition would be such as to indicate sickness to the most common observer; and in a month it would, most likely, be dead. — *Horticultural Times.*

ALLSPICE.

ALLSPICE, according to the *St. James Gazette*, is a spice *per se*, just as mace, cinnamon, cloves, nutmegs, etc., are, and is identical with the article known in its whole or uncrushed state as pimento, This latter is the fruit of a tree very much resembling the arbutus, and known as the *Eugenia pimenta.* It is a native of the West Indies, where it grows wild in the forests. Jamaica is, however, the only commercial source of pimento, though the plant can scarcely be said to be cultivated even there. The fruit is a small berry closely resembling the black pepper (hence the name, sometimes given it, of Jamaica pepper), and is eagerly sought by certain birds, which drop the seeds everywhere. The pimento springs up in thick clusters, grows apace, and soon forms dense copses. The cultivation consists simply in thinning these out. The shoots removed in this process are manufactured into walking-canes, umbrella handles, etc., for which the rich color, denseness, lightness, and toughness of the wood peculiarly fit them. The removal of the shoots is done systematically, and thus produces little lanes or paths through the copse, technically called "walks." The flowers of the pimento grow in clusters, like hawthorn blooms, only those of the pimento have a greenish cast. They are followed by the berries, which are gathered green, since, if allowed to ripen, they lose their aromatic odor, and spicy, pungent taste. The green berries are dried in the sun on raised platforms called "barbecues," and the drying is termed "barbecuing." Formerly pimento was used to a much greater extent than at present, but seems to be again coming into favor. The planters or growers get about four cents per pound for the dried berry; but even at this low rate the Jamaicans managed to export in 1880 about $750,000 worth (£146,000), — a pretty good sum on a commodity the sole labor that is expended on which consists of picking the berries, spreading them in the sun, and finally putting into sacks. These latter usually hold from twelve to thirteen "stone," or from a hundred and sixty-eight to a hundred and eighty-two pounds. Allspice is said to be less injurious than other kinds of spices, even when used to excess, and hence is taking their places in the various hygienic sauces now so much the "fad" in England and her colonies.

HORTICULTURAL HINTS.

IN ARRANGING a mixed border, the object should be the production of masses and sheets of bloom in the dwarf plants, and picturesque groups with the larger plants.

NATIVE MAIDEN-HAIR FERN FOR THE HOUSE. — Before the Michigan Horticultural Society, Mr. Garfield spoke of this plant (*Adiantum pedatum*) as being one of the most handsome for the decoration of rooms, and as not sensitive to a change of air. It needs but a short period of rest, being beautiful nearly the whole year round. Mr. Watkins said that plants can be obtained from the woods at any time when the ground is bare, and that they will start growth in a few days. It will do well with but little light.

FLOWERS FOR BEGINNERS. — The following are suggested by a horticultural journal: —

One paper each of white, scarlet, and mixed phlox, verbena mixed, mignonette, tropæolum, asters, pansies, and one ounce of sweet peas. Of these, only mignonette, tropæolum, and sweet peas can be sown in the open ground. The others must be started in hotbeds or in boxes in the house. Then, when your plants are nicely started, you can see how many you have, and will know how much ground to fit for them.

PRESERVATION OF FLOWERS. — A method of preserving the natural colors of flowers, recommended by R. Hegler in the *Deutsche botanische Monatshefte*, consists in dusting salicylic acid on the plants as they lie in the press, and removing it again with a brush when the flowers are dry. Red colors in particular are well preserved by this agent. Another method of applying the same preservative is to use a solution of one part of salicylic acid in fourteen of alcohol by means of blotting-paper or cotton-wool soaked in it and placed above and below the flowers. Powdered boracic acid yields nearly as good results. Dr. Schönland, in a paragraph contributed to the *Gardeners' Chronicle*, recommends, as an improvement in the method of using sulphurous acid for preserving the color, that, in the case of delicate flowers, they might be placed loosely between sheets of vegetable parchment before immersion in the liquid, so as to preserve their natural form.

LILY OF THE VALLEY. — A few words on the forcing of this may be of interest. The first thing required is bottom and top heat, with a temperature between seventy and seventy-five degrees. Have ready some boxes about eighteen inches long by nine wide, and some fine sifted leaf-soil. Prepare your crowns by cutting some of the long roots off, as the box will only want to be about three or four inches deep; place the crowns about one inch apart, until the boxes are filled. They are now ready for the forcing pit, or house, where they should be placed on a moist bottom heat, and covered with similar boxes, so as to keep them dark, and confine the moisture. The empty boxes should be removed occasionally, and the crowns watered with a fine rose-pot with water at about eighty degrees. As soon as the crowns are about two inches high, the empty boxes must be removed, so as to give the lilies time to strengthen; but if you wish for long, straggling spikes, your top boxes will have to be a foot deep. You will get your lilies in bloom quicker by keeping them quite dark, but you will find the flowers will not stand so long as those that have been brought on more gently.

The Popular Science News.

BOSTON, MAY 1, 1888.

AUSTIN P. NICHOLS, S.B. . . . . *Editor*
WILLIAM J. ROLFE, LITT.D. . . . . *Associate Editor*

It has been noticed, when pure oxide of zinc is heated over a Bunsen burner in a platinum crucible, that the platinum is blackened from the formation of an alloy with metallic zinc; and the only explanation hitherto offered has been, that the oxide was directly disassociated by the heat of the flame into oxygen gas and metallic zinc, just as water at very high temperatures is decomposed into hydrogen and oxygen. Messrs. Morse and Burton (*American Chemical Journal*) have investigated this point, and come to the conclusion that the effect is one of reduction rather than disassociation. They find that the burning gas-flame contains free hydrogen and oxygen, and that, owing to the greater diffusibility of the hydrogen through the heated platinum, it accumulates on the inside of the crucible, where it reduces the oxide of zinc to the metallic state by the usual reaction. Zinc being quite volatile at high temperatures, a very perceptible loss may be caused in this way in the course of an analysis, and the possibility of such a reducing atmosphere in a platinum vessel may be of importance in many other analytical processes.

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The legal restrictions upon the practice of medicine in Illinois are particularly severe, and the State Board of Health recently went so far as to revoke the license of a physician for having advertised in the newspapers. This action was promptly set aside by the courts, which maintained that every citizen has a constitutional right to advertise his business, and that the action of the Board was illegal. This decision seems to us to be a very just one; for although as a matter of fact no advertising physician is worthy of the slightest confidence, yet if a respectable doctor chooses to advertise his business, and run the risk of being classed with the quacks who spread themselves and their alleged cures so conspicuously before the public, it is going too far to say that he shall be prevented from doing so by law. Medicine is in one sense a profession, but in another sense it is a trade, and is governed by the same natural laws that affect all other forms of business.

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The close resemblance between the symbols for the dram (ʒ) and ounce (℥) in prescription-writing is likely to be a cause of numerous mistakes, which in some cases might even prove fatal. The *Medical World* suggests that the Greek letter delta (Δ) be substituted for the present dram symbol, thus preventing this source of error on the part of either prescriber or dispenser. We can see no objection to this change, except the natural slowness of mankind to alter an established habit, and should be glad to see the "delta symbol" in general use.

The difficulty experienced in breaking up an established habit, even if it be a trivial one, is very remarkable. The exchange editor on a paper in this city, who has to overlook some twenty or thirty periodicals each day, informs us that it is almost impossible for him to turn over the pages of the magazines in their proper order; but, in spite of numerous attempts to do so, he finds himself "reading them backward," commencing at the end, and turning the leaves toward the beginning, although at an actual personal inconvenience. There seems to be no reason of any kind for this proceeding, and it is probably only an instance of persistence of a habit accidentally formed.

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"A test for sewer-gas" has been going the rounds of the papers which deserves notice on account of its misleading character. It consists in exposing to the suspected atmosphere pieces of paper moistened with a solution of sugar of lead, which are supposed to indicate the presence of the dreaded gas by turning black. This test is entirely unreliable, and only indicates the presence of sulphuretted hydrogen, a very disagreeable gas, but not especially dangerous in small quantities. It is true that the air of sewers usually contains more or less of this gas; but this is not always the case, as we have exposed such test-papers for half an hour over the open mouth of a very offensive sewer without the slightest discoloration taking place. There is no definite test for sewer-gas known, and it is much better to avoid all possibility of its presence than to depend upon any chemical tests for indications of its existence.

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The decision of the Supreme Court in regard to the validity of the Bell telephone patent is very gratifying both to the owners of the property and those who have known the history of the invention from the beginning. There cannot be the slightest doubt that the telephone as first described and put into practical use was entirely the invention of Professor Bell. The charges of fraud in obtaining the patent were silly and puerile to the last degree; the claims of prior discovery by other inventors were, to say the least, very improbable; and the evidence brought forward at the hearing was weak and inconclusive. It is to be hoped that the claims of the inventor may not be called again in question.

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A subscriber sends us a photograph of the lower side of a window in a roof while covered with ice and snow, which is of interest as showing how the snow, while lying upon the inclined surface, and exposed to alternate thawing and freezing, has developed the structure of a glacier. As viewed from below, the centre portion seems to have moved forward faster than the sides, forming curved lines such as are observed in the larger glaciers flowing down the mountain-sides. This little patch of ice doubtless was a glacier on a small scale, although perhaps subject to somewhat different laws from those which control the movements of the larger members of the family.

QUANTIVALENCE.

The above term, familiar to every student of chemistry, is applied to certain laws of chemical combination, which, from their importance, may also possess a popular interest.

We presume it is known to most of our readers that the elements always unite among themselves in definite and unchangeable proportions. In the simple case of hydrochloric acid, for instance, which is composed of one volume of hydrogen and one of chlorine, the proportion by weight between the two is invariably as 1 to 35.5. And as hydrogen, being the lightest substance known, is taken as unity, it follows that the smallest weight of chlorine which will unite with it is 35.5 times as heavy an equal volume of hydrogen; or, according to the modern theory, the weight of an atom of chlorine is 35.5 times that of an atom of hydrogen.

Now, in all the investigations made by chemists, no other compound of hydrogen and chlorine has been discovered, and it is undoubtedly true that no other compound is possible. Therefore we may say that hydrogen and chlorine each possess one chemical affinity, like two magnets with a single pole, which mutually attract each other; and they are therefore said to have a quantivalence of one, and are called *monads*, from the Greek word *monos*.

Now, if we take another simple substance, water, and analyze it, we shall find that it consists of two volumes of hydrogen and one of oxygen; that is, the atom of oxygen has two affinities or poles, each of which fixes an atom of hydrogen: oxygen, therefore, has a quantivalence of two, and is a *dyad*. Representing these affinities by dashes, we may write the graphic symbol of water H — — O — — H, which shows clearly how the dyad oxygen holds the two monad hydrogens. Another compound of these gases — peroxide of hydrogen — is known, which contains equal volumes of hydrogen and oxygen; and the symbol must be written, H — — O — — O — — H, two of the oxygen affinities or valences combining between themselves. Usually, in writing these symbols, two dashes are condensed into one, which would make the above symbol H — O — O — H.

Ammonia is a compound of nitrogen and hydrogen, NH_3; and here we find a triad element, nitrogen holding three atoms of hydrogen. Carbon is a tetrad or quadrivalent element, and in marsh gas, CH_4, holds four atoms of monad hydrogen, and in carbonic dioxide, CO_2, holds two atoms of dyad oxygen; in either case displaying its four valences. Phosphorus is a pentad element, with five affinities, as shown in phosphoric chloride, PCl_5; while sulphur may have as many as six affinities, as in sulphuric acid, H_2SO_4, which may be graphically represented by the symbol

$$\begin{array}{c} O \\ \| \\ H-O-S-O-H. \\ \| \\ O \end{array}$$

Here the hexad sulphur is seen to hold two dyad atoms of oxygen

by four of its affinities, while two other oxygen atoms are held by one affinity each, the remaining one being united with the monad hydrogen; and it is important to notice that, in the chemical reactions of sulphuric acid, one half of the oxygen holds very different relations from the other half, corresponding to the different disposition of the valences or affinities in the molecule. No higher quantivalent than six is known to occur among the elementary bodies.

As it is impossible for any substance to exist with an unsatisfied affinity, it will be seen that no monad element can exist in a free state; and it is found by experiment that hydrogen gas, for instance, does not consist of a single atom, H —, but of a double atom, H —H, where the two affinities mutually satisfy each other.

One of the most remarkable circumstances in this connection is the fact that under different circumstances the same element may possess different quantivalences. Nitrogen, for instance, in ammonia gas, NH_3, is a triad; but in ammonic chloride, NH_4Cl, it is a pentad, with the power of holding five monads. Iron has two or four valences, while sulphur has either two, four, or six, according to the class of compounds of which it is a part.

It is not easy to explain these variations of quantivalence, which correspond in some degree, notably in the case of iron, to differences in their chemical and physical relations, which might almost indicate the compound nature of these so-called elements. The relation between the quantivalence and the atomic weight is an important feature of the recently discovered "periodic law" of the elements; but, like many other phenomena, we must content ourselves with observing the facts, and wait for future investigations to furnish a rational explanation of them. Whatever may be the reason, we know that every chemical element is possessed of a certain number, always either odd or even, of affinities, or power of uniting with or neutralizing the affinities of other atoms, and that no compound can exist unless every affinity of each atom is neutralized; that is, the sum of all the affinities in any molecule must be an even number. These laws are based upon actual experimental investigation, involving an immense amount of time and labor, and are among the fundamental facts on which the system of modern chemical philosophy is founded.

THE SNOW AS A BIRD-CATCHER.

THE number of birds annually destroyed by the cold of winter is very large, especially when the ground is covered with snow, so that they cannot obtain food from the earth. A Belgian gamekeeper has recently observed a new source of danger to birds from a fall of damp, adhesive snow. The accompanying spirited illustration is reproduced from *La Nature*, and shows a partridge securely held by a large snowball, while a flock of ravens feast upon him at their leisure.

FIG. 1.

FIG. 2.

It appears that during cold weather the birds resort to the nearest stream or other body of open water for the purpose of warming their feet. Their long tail-feathers becoming wet, when they return to the fields the snow adheres to them; and, as they drag it along, the ball continually increases in size, in the same way that the enormous snowballs which boys sometimes amuse themselves by rolling up are formed. After the ball becomes too heavy for the poor bird to carry it farther, he must either remain firmly anchored till destroyed by the cold or birds of prey, or else, if he is fortunate, he may be able to relieve himself of the weight of snow and his tail-feathers at the same time. Fig. 2 shows one of these snowballs with the tail-feathers still attached to it, which is copied from a photograph. The mass of snow weighed nearly ten ounces. It is not likely that such an occurrence would take place except under exceptionably favorable conditions, and we presume that a strong-winged wild bird would have less difficulty in freeing itself from a mass of snow than the semi-domesticated animals of a European game-preserve; but it is a curious instance of the many perils to which wild animals are subject, and may possibly be no small factor in the destruction of the weaker varieties of birds.

[Special correspondence of the *Popular Science News*.]

BERLIN LETTER.

THE University catalogue for the coming half-year announces a course of lectures by Professor Dr. Krause, physician to the Emperor, on laryngoscopy and rhinoscopy, as well as a free course on the pathology and anatomy of the nose, throat, and larynx. Professor Helmholtz leaves the University at the close of the next term, to take charge of the Imperial Physical and Technical Institute lately established in Charlottenburg. Professor Mommsen closed his lectures last semester, and is soon to make another trip to Rome for purposes of historical research. Perhaps the long-delayed volume on the Empire will be the result.

THE *Gesellschaft für innere Medicin* discussed in its meeting last Tuesday the subject of the cancer bacillus. Dr. Emil Senger gave the results of his bacteriological studies and experiments, proving satisfactorily that Scheurlen's bacillus (alluded to in my last letter) is not, after all, the germ of the disease, but merely a harmless bacillus of common occurrence in stagnant liquids and in the ground. Dr. Senger inoculated two hundred and fifty animals — mice, rabbits, dogs — with cancerous matter obtained from hospital patients, with no effect.

The cancerous particle produced only local inflammation of short duration. The lecturer maintained cancer to be contagious, and the disease-germ to be smaller than the lung-capillaries; but as yet the nature of the germ is unknown.

The minister of war is trying to relieve the cuirassiers of the burden of their cuirasses. The cuirassier is commonly severely injured by a fall from his horse, neck or ribs being especially liable to fracture. Even in the exercises in time of peace, the accident is not unknown. The difficulty of mounting is also to be considered. But the chief argument is, that the cuirass is no defence against the projectiles of modern warfare, but increases, rather, the severity of the wounds received. Conclusive proof of this was easily obtained by filling a cuirass with animal flesh, and making it the target for a few rifle bullets. Not only was it readily pierced, but pieces of the metal were driven into the substance of the flesh, adding to the severity of the wounds.

Photography is gaining increasing importance in the criminal courts. With its help a Berlin merchant was lately convicted of crooked ways in keeping his accounts. The slightest differences in color and shade of inks are made manifest in the photographic copy: blue inks appear nearly white; brown inks, on the contrary, almost black. The books of the accused were submitted to a photographer, who took off the pages concerned, and brought into court the most undoubted ocular proofs of the illegitimate after-entry of some of the accounts. A subsequent chemical test substantiated this evidence. The photographic is to be preferred to the chemical test, because it brings its proofs into the court, and submits them to inspection, at the same time leaving the document under examination unharmed; while the results of a chemical test must be taken on the evidence of the chemist alone, and the writing examined is perhaps destroyed. In another case similar to the above the changing of the date of a note by an insignificant erasure and addition was proved by means of photography.

The scientific and technical societies of Berlin are about to build a house for their common use. Three connected lots in the best quarter of the city have been secured, and a stock company formed, with the expectation that members of the interested societies will take the stock, of which 2,200,000 marks will be issued. The building will contain business and reading rooms to be rented to the several societies, and common assembly rooms. The control of the building will be in the hands of those renting its rooms, and thus the ends and aims of the enterprise confined strictly to purposes of science. Already different medical, chemical, polytechnical, electro-technical, geological, geographical, and anthropological societies have signified their approval of the plan, and a committee has been formed of leading scientists and physicians to direct the movement.

The Government is about to erect here a building for the execution of colossal statues and monuments. The estimated cost is thirty-eight thousand marks, which sum has already been appropriated.

At the Vienna International Balloon Exhibition, which is to be opened on the 1st of April, the German Society for the Promotion of Ballooning will be appropriately represented. Among other models of interest will be exhibited numerous appliances for aerial locomotion. In the course of the summer a series of ascensions for purely scientific purposes will be made. The buildings for the exposition are already completed, and the management is in the hands of a committee consisting of the landgrave Fürstenberg, Max Prince Fürstenberg, Alexander Prince Salms, and others.

An interesting essay on the prime meridian was recently sent to the French Academy of Sciences by Alexis von Tillo. As is well known, there is as yet no common meridian agreed upon by the different nations for the reckoning of longitude; England using the meridian of Greenwich, France that of Paris, Germany that of Ferro, and the United States that of Washington. By a series of computations, which need not be here described, Von Tillo found the co ordinates of the orographic centres of gravity of the four continents. These centres form a tolerably regular quadrangle, the longest side being that connecting the centres of Asia and North America. It is ninety-two degrees long, and lies between the parallels 43 and 45 north latitude The line connecting the centres of Africa and South America is eighty-two degrees in length, lying between the tropics. The geometrical centre of this quadrangle lies near the Azores and Canary Islands; and as the meridian of Ferro cuts this region, the writer claims this as the natural prime meridian of the earth.

Berlin, *Feb.* 24, 1888.

[Original in *Popular Science News.*]

HOW BIRDS LEARN TO SING.

BY SAMUEL BRAZIER.

Most people probably imagine that birds sing by instinct; that the song of the robin is as natural to him as his red breast; that the bluebird is not more liable to change its note than its color; and that, untaught, the nightingale will always sing the same beautiful song.

This common impression, however, is erroneous. Young birds will never sing the song peculiar to their tribe if they have never heard it, but if associated with some other bird, will learn its song instead. A redstart once built its nest under the eaves of a house where a caged chaffinch hung in a window underneath. The redstart learned the chaffinch's song. Another redstart was noticed to repeat the notes of a blackcap which had its nest close by.

The whinchat and wheatear have naturally but little variety of notes, but will become much better songsters if confined with other birds; and the bullfinch can be taught to whistle complete tunes, although its own natural notes are harsh and insignificant. On the other hand, the nightingale in confinement will sometimes exchange its own beautiful song for that of some other bird that it may hear. The Hon. Daines Barrington says that he saw a linnet which had been taken from the nest when only two or three days old, and which, not having any other sounds to imitate, almost learned to articulate, and could repeat the words "pretty boy" and some other short sentences. He educated nestling linnets under the three best-singing larks, — the skylark, woodlark, and titlark, — every one of which, instead of the linnet's song, adhered entirely to that of their respective instructors. When the note of the titlark was thoroughly fixed, he hung the linnet which had learned it in a room for three months with two common linnets which were in full song. The educated linnet, however, never borrowed any passage from the other linnets, but adhered steadfastly to that of the titlark which it had learned. At Knighton, in Radnorshire, he saw a goldfinch which sang exactly like a wren, and uttered no proper note of its species. This bird had been taken from the nest when it was only two days old, and was hung in a window opposite a small garden, where it had, no doubt, heard and learned the wren's song, having never had the opportunity to learn that of the goldfinch. Birds taken from the nest two or three weeks old have already learned the call-notes of their species. These and many similar facts go to prove that birds do not sing by instinct. They learn their songs from their parents. If they have no opportunity of hearing the song peculiar to their species, they never sing it, but will learn any other instead; just as an American child taken to France when a few weeks old, would never speak English if he never heard it, but would learn to speak French.

[Specially reported for the *Popular Science News* from the Observatory of the College of New Jersey.]

ASTRONOMICAL PHENOMENA FOR MAY, 1888.

The Planets. — Mercury passes superior conjunction with the Sun on May 10, and becomes an evening star. At the end of the month it sets about an hour and a half after sunset, and may be seen in the twilight. Venus is still a morning star, but is approaching the Sun, and is not in very good position for observation. Mars is still in good position for observation, but is increasing its distance from the Earth, and growing fainter. It is on the meridian at about 10 P.M. on May 1, and at about 8 P.M. on May 31. It moves slowly westward until May 21, when it begins to move eastward among the stars. It is west and north of the first-magnitude star Spica (*Alpha* Virginis). Jupiter is in the constellation Scorpius, moving slowly westward. It is near the second-magnitude star *Beta* Scorpii, passing it on May 20 at a distance of only 2′. At this time the star will be too near the planet to be seen with the naked eye The planet is on the meridian about $1^h.\ 30^m.$ A M. on May 1, and at about $11^h.\ 20^m.$ on May 31. It is in opposition with the Sun on May 21.

For the benefit of owners of small telescopes I give a list of the eclipses of Jupiter's satellites which are visible in the United States during the month. Before opposition, only the disappearances can be seen, the reappearances occurring while the satellite is behind the planet. After opposition, only the reappearances are seen, for a similar reason. As seen in an inverting telescope, the disappearances take place on the upper left-hand quadrant, and the reappearances on the upper right-hand quadrant, very close to the limb, as the shadow at opposition is directly behind the planet. The satellites are designated as I., II., III., and IV., in the order of increasing distance from the planet. The times given are Eastern standard time.

Disappearances.	Reappearances.
II. — May 2, 5h. 26m. A.M.	I. — May 23, 11h. 55m. P.M.
I. — May 6, 5h. 2m. A.M.	II. — May 27, 4h. 54m. A.M.
I. — May 7, 11h. 31m. P.M.	I. — May 31, 1h. 49m. A.M.
II. — May 12, 9h. 19m. P.M.	
III. — May 13, 10h. 24m. P.M.	
I. — May 15, 1h. 25m. A.M.	
II. — May 19, 11h. 54m. P.M.	
III. — May 21, 2h. 22m. A.M.	

With small telescopes the satellites also disappear when they are between the Earth and Jupiter.

Saturn is still in the western sky in the evening, setting before midnight. It is in the constellation Cancer, and forms a large triangle with *Beta* Geminorum and *Alpha* Canis Minoris. Uranus is in Virgo, about 8° north and west of Spica (*Alpha* Virginis). On May 5 it is south of Mars at a distance a little greater than the moon's diameter. Neptune is in conjunction with the Sun on May 19.

The Constellations. — The positions given hold good for latitudes differing not many degrees from 40° north, and for 10 P.M. on May 1, 9 P.M. on May 16, and 8 P.M. on May 31. Canes Venatici is in the

zenith. To the south on the meridian are Coma Berenices, Virgo, with Mars and Uranus, and Corvus. A few of the most northerly stars of Centaurus are on the south horizon. In the south-east is Libra; and below it, just rising, is Scorpius with Jupiter. Boötes is high up east of the zenith, and below it are Hercules and Ophiuchus. Lyra and Cygnus are low down in the north-east. The principal stars of Draco are above, at about the same altitude as the pole star. Cassiopeia is on the north horizon. Perseus and Auriga are setting in the north-west. Ursa Major is high up near the zenith, most of the stars being west of the meridian. Gemini is near the western horizon. Cancer, with Saturn and Leo, follow above to the left. Canis Minor is below Cancer near the south-west horizon.

M.

PRINCETON, N.J., *April* 4, 1888.

[Specially reported for the *Popular Science News.*]

METEOROLOGY FOR MARCH, 1888.

TEMPERATURE.

AVERAGE THERMOMETER.		Lowest.	Highest.	Range.
At 7 A.M.	27.42°	13°	45°	32°
At 2 P.M.	36.16°	24°	49°	25°
At 9 P.M.	30.97°	16°	49°	33°
Whole month	31.52°	13°	49°	36°
Last eighteen Marches	32.25°	24.45°, in 1872.	39.18°, in 1878.	14.73°

The 24th was the coldest, and the 21st the warmest, day of the month, averaging 18° and 47⅔° respectively. The lowest point reached was 13°, on the 24th, and the highest 49°, on the 21st, at 2 and 9 P.M.; the extremes coming thus near each other. The entire month was .73° below the average of March in eighteen years. The second average was 31.38°, which is considered within a small fraction of the true average, if taken at each hour of the twenty-four. The most sudden change was 25° in seventeen hours, between the 22d and 23d.

THE SKY.

The face of the sky the past month in 93 observations gave 48 fair, 14 cloudy, 19 overcast, 5 rainy, and 7 snowy, — a percentage of 51.6 fair. The average fair the last eighteen Marches has been 50.3, with extremes of 33 3, in 1881, and 63.4, in 1883. From the 4th to the 8th, and from the 15th to the 19th, inclusive, were periods of five days each, of fine, pleasant weather. Between these, on the 12th, began the great storm covering most of the Middle and New-England States. It was much less severe in this locality than farther south. Snow fell heavily all day and night, mingled largely with rain; but the temperature was sufficiently low, ranging from 26° to 37°, to load the trees heavily with snow for two days. The wind was light, varying from east to north. Snow fell in small quantities on the 13th and 14th, increasing the amount, which fell chiefly on the 12th, to about 12 inches. Had it been a few degrees colder, changing all the rain into snow, the amount would have been two to three times greater, as the amount of melted snow and rain together equalled nearly 3 inches. The rain, intermingling with the damp, fast-falling snow, formed a compact resistance not easily overcome by the snow-plough, and railroad travel was impeded as perhaps never before. This storm will be long remembered. The morning of the 21st was foggy.

PRECIPITATION.

The amount of precipitation the entire month, including the 12 inches of snow melted, was 8.40 inches; while the average for the last twenty Marches has been only 5.31, with extremes of 1.18, in 1885, and 10.22, in 1877. The present amount has been exceeded in March but three times in the twenty years. The amount since Jan. 1 has been 19.83 inches, for only three months. The snow-storm, 12th to 14th, furnished sleighing for about one week, when the snow nearly disappeared in a heavy rainfall of 2.69 inches on the 21st.

PRESSURE.

The average pressure the past month was 29.943 inches, with extremes of 29.10, on the 13th, and 30.46, on the 26th, — a range of 1.36 inches. The average for the last fifteen Marches has been 29.884, with extremes of 29.639, in 1881, and 29.991, in 1882. The sum of the daily variations the last month was 7.33 inches, giving an average daily movement of .236 inch. This average the last fifteen Marches has been .242, with extremes of .198 and .290. The largest daily movements were .92 inch, on the 12th, .53, on the 21st, and .52, on the 13th; two of these were in connection with the great storm, and the other with that heavy rainfall. The lowest depressions were on the 13th and 21st, and the highest on the 2d, 10th, 19th, and 26th; the last three just before heavy precipitation.

WINDS.

The direction of the wind in 93 observations gave 11 N., 0 S., 5 E., 20 W., 7 N.E.. 35 N.W., 4 S.E., and 11 S.W., — an excess of 38 northerly and 50 westerly over the southerly and easterly, and indicating the average direction the past month to have been W. 37° 14′ N. The westerly winds in the last nineteen Marches have uniformly prevailed over the easterly, with a single exception, by an average of 39.68 observations, and the northerly over the southerly, without an exception, by an average of 24.05; indicating the approximate general average of March to be W. 31° 38′ N. The relative progressive distance travelled by the wind the last month was 62.80 units, and during the last nineteen Marches 881.7 such units, — an average of 48.51; showing far less opposing winds than usual.

D. W.

NATICK, *April* 5, 1888.

QUESTIONS AND ANSWERS.

LETTERS of inquiry should enclose a two-cent stamp, as well as the name and address of the writer, which will not be published.

QUESTIONS regarding the treatment of diseases cannot be answered in this column.

R. F., *New Hampshire.* — What can be used upon the woodwork of butter packages, to keep them clean and sweet, and prevent mould?

Answer. — We should recommend you to try soaking the wood in hot melted paraffine, which will render it water-proof and non-absorbent.

W., *Massachusetts.* — Have the results of the observations of the transits of Venus in 1874 and 1882 ever been made public?

Answer. — The reduction of these observations is a work requiring an immense amount of time and labor, and is not yet completed.

W. F. K., *Louisiana.* — What will remove old varnish from woodwork without injuring it?

Answer. — Most varnishes are soluble in alcohol, and this will probably answer your purpose.

E. A. W., *Iowa.* — If a person is struck a violent blow upon the eyes, the appearance of a flash of light is observed. Will this light render objects in a dark room visible to the person receiving the blow?

Answer. — We do not think this possible, although there is a popular belief to that effect. The light is caused by the irritation of the optic nerve by the blow, while the sensation of sight is caused by its excitation by the light waves proceeding from the objects it perceives. This question was brought up some years ago in a trial of two highwaymen in France, where the victim claimed to have recognized them by the light produced by the blow which he received at the time of the robbery.

O. B. S., *New York.* — What are "madstones"? and what is the principle of their action?

Answer. — Madstones are usually a piece of some porous stone, usually limestone. When applied to a wound caused by the bite of a mad dog or venomous animal, it is claimed that they will draw out and absorb the poison, thus preventing any bad effects. It is hardly necessary to say that the benefits derived from them are purely imaginary.

Inquirer. — What causes the blood to circulate through the veins?

Answer. — The circulation is due to the contraction and dilation of the heart, which acts on the same principle as a force-pump. Some physiologists consider that the arteries themselves aid in the process by their expansion and contraction, but this theory has not as yet been confirmed.

H. C. W., *Massachusetts.* — What substance can be dissolved in water so that it will retain its heat longer when used to fill foot-warmers?

Answer. — A saturated solution of acetate of soda in hot water has been used for this purpose. It will retain its heat a long time, or until the acetate of soda has crystallized. It can be used over again indefinitely by reheating till the crystals are dissolved.

S. L., *Boston.* — The temperature of the water in a steam-boiler at a hundred and fifty pounds pressure is about 364° F. The temperature does not rise proportionally to the pressure, and the values for different pressures have been obtained by actual experiment.

LITERARY NOTES.

Industrial Instruction. By Robert Seidel, Mollis, Switzerland. Translated by Margaret K. Smith, Oswego, N.Y. 170 pp. Price 80 cents. D. C. Heath & Co., publishers, Boston, New York, and Chicago.

Besides a skilful refutation of the objections that have from time to time been raised against industrial instruction in the schools, the author has presented in this book a philosophical exposition of the principles underlying the claims of hand-labor to a place on the school programme.

What shall Make Us Whole? By Helen Bigelow Merriman. Cupples & Hurd, publishers, Boston, Mass. Price 75 cents.

This little treatise upon the "Mind Cure" is, according to the author, "a rough and imperfect sketch of a spiritual possibility now coming into the field of human vision." Those who are already believers in this system of treating disease will read the book with interest, as it is extremely well written, and free from the many absurdities of other writers on the subject; but there is very little, either in the way of fact or argument, to cause any change of opinion among those who prefer to trust in the old-fashioned physicians and medicines.

Messrs. A. Lovell & Co., New York, publish a set of *Graphic Drawing-Books* ($1.20 per dozen), by Hobart B. Jacobs and Augusta L. Brower. They are of different grades, and suited to all classes of pupils. They give much incidental information regarding art and artists, and are accompanied by a *Handbook* containing full directions for instruction of pupils by the system. Teachers will do well to send for samples of these books.

The new weekly horticultural journal, *Garden and Forest*, improves with every number, and will undoubtedly fill a place hitherto unoccupied in the journalistic field. Its list of contributors includes nearly all the prominent botanists and horticulturists in the country. Published, at $4.00 per year, by The Garden and Forest Publishing Company, Tribune Building, New York. Subscriptions will be received by the Popular Science News Company for both papers, at $4.50 per year.

Pamphlets, etc., received: Essays of the American Public Health Association, Concord, N.H., including *Healthy Homes and Food for the Working Classes, The Sanitary Conditions of Schoolhouses, Prevention of Infectious Diseases*, and the *Prevention of Disease, Injury, and Death in Manufactories* (price 5 cents each); *Igiene Sperimentale*, by Guiseppe Sormani, Pavia, Italy; *Duality of the Brain*, by R. C. Word, M.D., Atlanta, Ga.; *The Cutter Stem Pessary*, by Ephraim Cutter, M.D., New York; *The Drainage of a House*, by William Paul Gerhard, C.E., New York; *The Alcohol Question*, by Professor G. Bunge, Basle, Switzerland; *Comparative Data from Two Thousand Indian Crania*, by R. W. Shufeldt, M.D.; *Schools and Practical Life*, by Joel W. Smith, Charles City, Io.; *Report of the Italian Agricultural Experimental Station* at Rome; and the *Report of the Wisconsin State Board of Health.*

Medicine and Pharmacy.

MAN AS A STEAM-ENGINE.

A broad and general distinction may be made between a plant and an animal, in that one is a reducing agent, decomposing carbonic dioxide and water, and building up into its structure various complicated hydrocarbons and nitrogenous bodies, while the action of the animal organism is an oxidizing one, as it takes the substances stored up by the plant, and changes them once more into water and carbonic dioxide. In this process heat and energy are developed, and in this way man obtains his capacity for action and work; while his resemblance to a steam-engine, which produces its power in a mechanical way, albeit by the same oxidizing process, is a very curious one.

First of all, the engine must have fuel, or some material which is capable of oxidation or combustion. The machine is satisfied with simple carbon, or coal; but the human organism requires a more complex arrangement of the molecules of carbon and hydrogen which it is to burn, so it must be fed upon starches, sugars, albuminoids, etc., which are as truly burned in the human system as the coal is in the furnace, and in both cases develop heat and power.

The stomach may be considered as the "fire-box" of the human machine, although, strictly speaking, it is a place where the fuel is prepared for combustion. To state just how and where in the body the molecules of carbon and hydrogen are oxidized, would be a hard and unsatisfactory task. A part of the oxidation, however, takes place in the lungs, where the oxygen molecules are absorbed by the circulating blood from the air, and carried to all parts of the body. Here also carbonic dioxide and aqueous vapor are given off, so that the connecting windpipe may be considered as the smoke-stack and exhaust-pipe of the human engine.

Water is, of course, required both by the steam-boiler and the animal. The steam-pipe which carries the force to the cylinder of the engine is best represented in the human body by the arteries. The heart is a perfect natural pump; and a lively imagination might regard the liver as corresponding to the "feed-heater" of the engine, though the comparison would be rather far-fetched. The piston-rods, levers, and other moving parts of the engine are supplied by the limbs and muscles; and if, through excessive action, the "pressure" becomes too high, we have in the perspiration a safety-valve which at once cools down the heated system. If the perspiratory ducts become clogged, the consequences to the body are almost as serious as the failure of the safety-valve is to the steam-boiler.

The excretion of the waste products of the body through the natural channels, and the removal of the ashes from under the boiler of the engine, need only to be mentioned to be brought into the comparison.

Thus we see, that, from a strictly material point of view, man is but a piece of machinery, burning carbon, and giving out heat and work. But there the resemblance stops. The engine requires an engineer to run it and keep it in order: but the human engine not only keeps all its complicated machinery working smoothly, but, to a limited extent, possesses the power of repairing its own injuries, and even of reproducing other forms like itself; so that, when it is finally worn out, the work of the world will go on. What this mysterious something which we call the vital force is, or whether the engineer of the human machine really has his post in the brain, as is generally believed, are mysteries which have hitherto been, and probably always will be, unsolvable. The mechanical and chemical processes of man and machine are closely analogous, but over and above all is the great mystery of life. The giant steamship, propelled by its massive and powerful engines, moves across the ocean like some great sea-monster; but the tiniest speck of organized protoplasm in the depths below, possesses powers which not even the builder of the steamship can bestow, and in comparison with which it becomes but a worthless mass of wood and metal.

SIMPLE SPHYGMOGRAPHS.

The sphygmographs, which show and record the rate and nature of the pulse-beat, are usually quite complicated and expensive instruments. In a recent number of *La Nature* two forms are illustrated which cost almost nothing, and for many purposes are equally useful with the more expensive ones.

The first form shows the rate and force of the pulse-beat to the eye, by the movements of a little flag attached to a wire spring. A

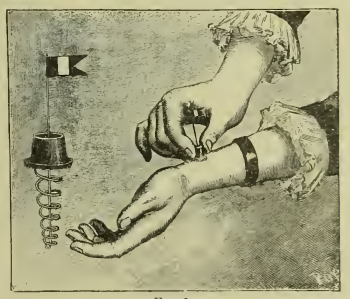

Fig. 1.

piece of fine brass wire is soldered at one end to a little metal cup, — a thimble without a top, for example, — and is then bent into a spiral spring, as shown in the engraving, with the straight end passing up through its centre, and provided at the extremity with a little paper flag. On pressing the instrument upon the wrist over the artery, the pulse-beats will be transmitted to the spring; and the flag will make various movements, according to the condition of the pulse of the person experimented upon. If desired, it can easily be arranged so that, at each movement of the upright wire, it shall strike against another wire, and close an electric circuit, into which a telephone or electric bell may be introduced, thus rendering the beats perceptible to persons at a distance.

A still simpler sphygmograph consists of a small piece of looking-glass fastened to the

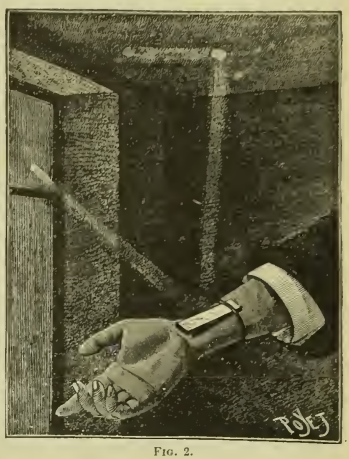

Fig. 2.

wrist by a rubber band. A pencil of light, either natural or artificial, is allowed to fall upon the glass, and is reflected upon the ceiling, or a screen placed in any convenient position. By this means the pulsations are greatly magnified, and can be rendered visible to a large number of persons at once. This simple arrangement is especially well adapted for the use of lecturers.

THE COCA-PLANT.

Erythroxylon Coca (Lamarck), of the Linnaceæ family, is found in the same equatorial countries where cinchona (Peruvian-bark tree) grows It is a small tree, from six to nine feet in height, cultivated in the various parts of South America, principally in Peru and Bolivia, Ecuador, New Granada, and Brazil. Its trunk is covered by a rough, generally glossy bark. Its branches, often compressed near the top, bear alternate leaves, very variable in their dimensions, elliptical, and of a green color, darker on the outside than on the inside.

The distinctive character of these leaves is the disposition of their veins; viz., there are observed by the side of the middle fibre two longitudinal lines jutting out, which separate at the base of the leaf, and meet again at the point, each describing a slight curve. Its branching root, with oblique divisions, ends in delicate rootlets. Its flowers — small, white or greenish yellow — are found either solitary or grooped in small scaly cavities. Its fruit is a pericarp, containing a seed in which the embryo is usually surrounded by abundant pabulum.

A light and silicious soil, a mean temperature of from fifteen to eighteen Centigrade, and a certain quantity of moisture, are the essential conditions for the perfect growth of coca. According to Papig, in the valleys of Chincao and Cassapit the ground where coca best flourishes is slanting, relatively steep, but very fertile, composed of brick-red clay, containing probably some iron.

Coca-seeds are sown in beds, called "almazigos." The young plants are protected from the heat of

the sun's rays by means of straw mats or woven branches, and are afterward transplanted in furrows about eighteen centimeters wide and eight deep, about one foot apart from each other, the interspaces being planted with maize, which protects by its shade the young plants. Under the beneficial influence of the sun and rain, the growth of the young tree is rapid; it blossoms at the end of from four to six months, and soon yields seed The coca-tree attains its complete height (two meters and a half on an average) at the end of about five years.

Attempts have been made to acclimatize it in Europe, but so far without success. Frail specimens may be found in the botanical gardens of Paris, London, and other large cities, and also at the establishments of some of the great horticulturists of Belgium. Corsica and Algiers seem to possess the climatological conditions necessary for the perfect development of the coca, and for that reason it is in these two countries where we should pursue our efforts of culture.

The plant commences to give its first crop at the end of about one year and a half. The gathering must be done in dry weather; it is generally confided to women, and consists simply in detaching each leaf with the fingers. The leaves are collected in aprons, stored with care under awnings or in bags, sheltered from rain and dampness, dried, and then packed. In 1851 the annual production of coca-leaves in Bolivia was estimated to be over 400,000 certos (4,600,000 kilograms), of which three-fourths came from the province of Yungas In 1850 the Bolivian Government collected a revenue from coca of not less than 900,000 francs; in 1859 the sum went up to 1,500,000 francs.

We quote from Paul Marcoy's "Voyage in the Region of the Titicaca," published in *Around the World*, May, 1877: "Of all the valleys of the group of Carabaya, Ituata is the one where the coca is cultivated on the largest scale. They were then in full harvest; peons and peonnes followed each other through the plantations of that shrub, so dear to the natives that a decree of 1825 had it placed in the coat-of-arms of Peru, together with the vicugna, and the cornucopia, or horn of plenty. Men and women carried, slung over their shoulders, cloths in which were placed the leaves they had gathered one by one. These leaves, spread out on large mattings, were exposed to the sun's rays for two or three days, and then packed up in bags of about one meter in size, and sent over the entire territory. This harvesting of coca is for the natives of the valleys an occasion of great rejoicing, as is for our farmers their harvest and vintage time. On the day when all the crop is gathered in, both sexes meet, and celebrate it by dancing, drinking, and various sports." — *From Mariani & Co.'s Treatise.*

THE FUNCTIONS OF THE SUPRA-RENAL CAPSULES.

The question of the uses of the supra-renal capsules is one that has heretofore quite baffled the researches of physiologists; the weight of opinion being, that they were fœtal or rudimentary bodies, having no especial function in the adult life of man. A careful study of the subject, however, has recently been made by Dr. C. A. Macmunn (*The British Medical Journal*, Feb. 4, 1888), with the result of furnishing a very plausible theory as to these organs, and of rehabilitating them into functional importance in the economy.

Dr. Macmunn shows, first of all, that from the point of view of comparative anatomy the supra-renal capsules are not rudimentary structures, but that they increase in relative size and anatomical complexity with the rise in the scale of animal life. They are formed in part from the ectoderm and in part from the mesoderm. The ectodermal part is furnished by sympathetic ganglia, and it forms the medullary or nervous portion of the gland. The mesodermal part forms the cortical or glandular portion. In mammals this part predominates, making of the capsules an essentially glandular organ. The increase in size and importance of the supra-renals in birds and mammals, as compared with fishes and reptiles, corresponds with the increase of the respiratory pigments.

As to the physiological chemistry, there have been found certain chromogens (Krukenberg), besides hippuric and taurocholic acids — benzoic acid, taurin, and inosit. The presence of these products indicates a very active downward or retrograde metamorphosis.

Dr. Macmunn has found, by spectroscopic test, the bands of hæmochromogen or reduced hæmatin Now, this substance is never found in any but excretory fluids of the body (liver, bile). Hence it is concluded that the supra-renals have an excretory function. He also found substances, such as histohæmatin, which are antecedent to the hæmochromogen. This fact supplied additional evidence that the capsules were excretory bodies.

If these glands are excretory, it ought to follow that in Addison's disease, involving the supra-renals, and impairing their function, the urine would contain incompletely metabolized pigments. This is exactly what he did find. In the urine of Addison's disease he observed a peculiar pigment which he calls urohæmatin, or, more strictly, "urohæmato porphyrin." This pigment is only found in the urine when an excess of effete hæmoglobin is present in the circulation, so that the blood-glands are unable to use it up, or when, the hæmoglobin being normal, the blood-glands are diseased and cannot reduce it, as in cirrhosis of the liver, Addison's disease, and Hodgkin's disease, involving the supra-renal capsules, and causing bronzed skin. Since in many cases in which he found this pigment the only glands diseased were the supra-renals, these, he thinks, must be blood-glands.

In cases of Addison's disease there are often very severe nervous symptoms of a depressive character, combined with hyperthermia or subnormal temperature. The symptoms sometimes resemble those of sepsis. Foa and Pellacani found that aqueous and alcoholic extracts of the supra-renals injected into the veins of rabbits produced toxic phenomena of a severe and characteristic type The poison was of a septic nature, causing, finally, paralysis of the spinal cord and of the bulbar centres. It was believed to be a nitrogenous, non-crystallizable substance, akin to Panum's septic poison. The conclusion is, that another function of the supra-renals is to remove or use up certain poisonous metabolites that accompany the worn-out pigments.

Summarizing the foregoing, therefore, it is concluded that the supra-renals are blood-glands having the function of removing effete pigments and effete proteids. When the organs in question are diseased, these products circulate in the blood, producing, on the one hand, pigmentation of the skin, on the other, the depressive effects of a septic poison.

As the supra-renals are not the only blood-glands, it does not follow that serious phenomena always result from their disease. Their duties may be performed by other organs having allied function. — *Medical Record.*

Fumigation is said to have originated with Acron, a physician of Agrigentum, who caused great fires to be lighted, and aromatics to be thrown into them, to purify the air.

MEDICINE FOR THE IMAGINATION.

What we have said of hypnotism, and particularly of suggestion, may lead the reader to understand the virtue of medicine for the imagination, of which the importance has already been intimated by earlier writers. Deslon asked why, if medicine for the imagination was the most effective, it should not be employed.

We must be permitted to dwell for a moment on this medicine for the imagination, which is entitled to the name of suggestive therapeutics. The process is as follows: Influenced by a persistent idea, suggested by external circumstances, a paralysis is developed The physician makes use of his authority to suggest the idea of an inevitable, incontestable cure, and the paralysis is cured accordingly. This cure, as well as the development of functional disturbance, was directly effected by an idea. An idea may therefore be, according to circumstances, a pathogenic and a therapeutic agent. This notion is not new; but, since it was misinterpreted, it has remained unfruitful.

The most important of the organic disturbances produced by an idea is an experiment on vesication, performed by Focachon, a chemist at Charmes. He applied some postage-stamps to the left shoulder of a hypnotized subject, keeping them in their place with some strips of diachylon and a compress; at the same time he suggested to the subject that he had applied a blister. The subject was watched, and when twenty hours had elapsed, the dressing, which had remained untouched, was removed. The epidermis to which it had been applied was thickened and dead, and of a yellowish-white color; and this region of the skin was puffy, and surrounded by an intensely red zone.

It was in 1869 that Russell Reynolds first noted the existence of motor and sensory disturbances, developed under the influence of an idea. The motor disturbance sometimes consists in spasms, in ataxic or inco-ordinated movements, and more frequently in paralysis, which affects the upper limbs. Erb gives to these symptoms the name of imaginative paraplegia.

The type of this paraplegia is afforded by Reynolds's first observation, which concerned a young woman who was affected by paraplegia under the following circumstances: She lived alone with her father, who had undergone a reverse of fortune, and who became paralytic in consequence of protracted anxiety. She supported the household by giving lessons, which involved long walks about the town. Influenced by the fatigue caused by so much walking, it occurred to her that she might herself become paralyzed, and that their situation would then be terrible. Haunted by this idea, she felt a growing weakness in her limbs, and after a while was quite unable to walk. The pathology of the affection was understood by Reynolds, who prescribed a purely moral treatment. He finally convinced his patient that she was able to walk; and, in fact, she resumed the practice. — *From "Hypnotism in Disease and Crime," by* MM. Binet *and* Féré, *in Popular Science Monthly for April.*

[Specially compiled for the *Popular Science News.*]

MONTHLY SUMMARY OF MEDICAL PROGRESS.

BY W. S. WELLS, M.D.

Sir Morell Mackenzie, in a letter published in a late issue of the *Australasian Medical Gazette*, commenting on a paper by Dr. Scot-Seiveking on tracheotomy, says, "I agree with nearly every thing in it, but I wish to raise my voice against the use of chloroform. I have performed the operation of tracheotomy between seventy and eighty

times, and consider that the use of a general anæsthetic enormously increases the danger in opening the air-passages. When bleeding takes place in the throat, and the patient is under the influence of chloroform, the reflex act of coughing does not take place, owing to the anæsthetic state of the air-passages, and the patient becomes suffocated because unable to cough out the blood. Many patients have died from this condition. Ether is even more objectionable than chloroform, being more irritating.

I have always found simple freezing of the surface quite enough; but if more complete local anæsthesia is desired, the subcutaneous injection of cocaine, after using the spray of ether, will produce absolute insensibility during the entire operation.

In the case of the Emperor of Germany, the opinion of Sir Morell in favor of tracheotomy *versus* resection has been lately confirmed by the death of several patients who had undergone the latter operation.

It is not every day that the general practitioner is called upon to perform the operation of aspirating the heart; but it is well to be informed upon this subject, if the opinions of M. Budin should become popular. He thinks that puncturing the heart is not dangerous in the majority of cases, and that it is calculated especially to remedy the dilatation of the right heart incident to distension, and where there is no organic lesion.

He recommends that the aspirating needle should be inserted in the third intercostal space on the right side, and close up to the edge of the sternum in aspirating the auricular cavity. When the ventricle is to be aspirated, the needle should enter the fourth intercostal space on the left side, close to the left edge of the sternum.

Puncture of the ventricle should be preferred, as the cardiac wall is much thicker and less prone to tear, and there is less liability to hemorrhage into the pericardium.

In *Progrés Médical*, Professor Adamkiewicz claims to have obtained remarkable results from the combined action of chloroform and the constant electric current, in facial and other forms of neuralgia. The electrode is made of hollow charcoal, into which the chloroform is introduced, and from which the current sends it into the tissues.

That this power of penetration may be thus obtained, is thought to be shown in the fact that when chloroform is colored with gentian violet, and applied as described to the ear of a rabbit, the tissue becomes dyed.

In the human subject, the action of the constant current and the chloroform produced a burning sensation, followed by local anæsthesia, except where the nerves are deep-seated, as in sciatica.

Dr. A. H. Newth (*London Lancet*) recommends the hyposulphites in the treatment of the bites of rabid dogs, and also their administration after the development of hydrophobia.

After a bite by a mad dog, he would give (to a child) five or ten grains of the hyposulphite of sodium or magnesium (the latter is richer in sulphurous acid), in caraway water with sirup, every four hours for the first three or four days, then three times a day for a week, then every morning early for one month; recommending a Turkish bath twice a week. When the disease has developed, he prescribes the hyposulphite every hour, with hot-air baths to induce perspiration. The hypodermic injection of hyposulphite might also be tried, especially if the patient is unable to swallow. Dr. Newth has used this remedy repeatedly in cases of blood-poisoning, with the most marked success; as, for example, a patient has received a punctured wound which has inflamed, the lymphatics have become swollen and reddened, the parts are extremely painful, and there are rigors. Within a short time after the exhibition of the hyposulphites, the pain has decreased, the parts are less inflamed, and symptoms of poisoning have abated. Nearly thirty years ago Professor Polli of Milan suggested the use of sulphurous acid in cases of blood-poisoning, and proved by experiments that dogs that had putrid blood injected into their veins, quickly died; if the hyposulphite of sodium was previously mixed with the injected blood, they were not affected; also if the hyposulphite was administered to the dogs either before or immediately after the injection of putrid blood, they did not suffer therefrom.

M. Pasteur recently presented to the *Académie des Sciences*, Paris, a communication, the work of MM. Roux and Cumberland, claiming that immunity may be gained against septicæmia by the inoculation of certain soluble substances. It is stated that the septic microbe, in its growth, develops chemical products which react upon itself, until finally it is destroyed by its self-engendered poison.

Roux and Cumberland have isolated these soluble products, and, by injecting them into guinea-pigs, have made these animals incapable of being affected by the septic vibrio.

These experiments have not been applied yet to the human subject; but if they should prove successful, their importance would be very great in the prevention of blood-poisoning by absorption of putrescent products.

Dr. Redard has communicated to the Paris Academy of Medicine some observations regarding the advantages of the skin of birds for grafts on wounds in human beings. He takes the skin from beneath the wing of a chicken, carefully securing the subjacent cellular tissue, but avoiding the adipose tissue. The transplanted pieces varied from a sixth to a third of an inch in size, and they were maintained in position by means of a little cotton-wool and iodoform gauze. The skin of birds and fowls has the advantage of being supple, delicate, and vascular, and is readily adapted to the surface of a wound, where it adheres without undergoing absorption.

In a case of severe burn of the scalp of eight months' standing, in a child two years old, he obtained rapid cicatrization by means of grafts from a fowl. The wound measured three inches by two and a half, and completely healed in two months.

Dr. D. Lichty of Rockford, Ill., communicates to the *New York Medical Record* a strong indictment against the butter-makers, and charges that butter may be a carrier of the germs of disease. He says it is the custom among the farmers in winter time to keep the milk in the kitchen, to prevent freezing, as it is often the only place in the house where a constant fire is kept. In this room the convalescents stay; and to it are often carried the sick, whatever may be the nature of their illness, whether diphtheria, scarlet-fever, or what not. Here the milk from which butter is made is kept in large shallow pans, sometimes on open temporary shelving. There is nothing to prevent the exhalations, desquamations, or disease-germs from being absorbed into the surface cream, which is skimmed off and made into butter, which is shipped any and every where to be consumed, without having been subjected to any influences, either thermal or chemical, to destroy or impair the infectious germs. Butter made in such an atmosphere and shipped to city markets cannot fail to be a dangerous factor, and doubtless many a well-watched and carefully isolated child has developed scarlet-fever or diphtheria from this source, without the mystery ever being explained.

In the treatment of tapeworm, Dr. Bettelheim, Vienna, recommends keratinized pills made of etherial extract of male fern, extract of pomegranate, each a hundred and fifty grains; powdered jalap, forty-five grains. Mix and divide into seventy pills, to be keratinized.

In the case of adults he gives from fifteen to twenty pills on the fasting day, the day before the cure; and on the latter day he gives the rest of them. These pills are insoluble in the stomach, but are soluble in the intestines, where they act directly upon the tapeworm. It may be advisable to follow the pills on the second day, after a few hours, by a brisk cathartic.

Drs. Doleris and Dubois announce, in the *Archives of Gynecology*, that they have used a solution of four per cent of cocaine to lull the pains of labor. A little glycerine may be added to the water. The cervix, vaginal walls, and vulva were freely swabbed with this solution during the first, second, and third stages of labor; the result in every case being to suppress the pains due to contraction of the uterus, dilatation of the os uteri, and to the dilatation of the vulva. The drug in no way interfered with the progress of labor. The uterine muscles contracted with their usual strength, labor was completed in the usual time, and pain was altogether absent.

[Original in *Popular Science News.*]

PHARMACEUTICAL NOTES.

The use of saccharin to replace sugar in the diet of diabetic patients, has led, in a recently reported case, to a curious result. After using it for some time, the patient found that he constantly had a sweet taste in his mouth, which was so disagreeable that the saccharin had to be discontinued. This effect is attributed to the fact that saccharin passes through the system unchanged, and so part of it found its way into the salivary secretions, and thus again did duty as a sweetener.

Antoine Chiris, the celebrated flower-grower of Grasse, has found the climate of Algeria well suited to the production of the plants and flowers yielding the more important essential oils and pomades. His plantations occupy an area of over two hundred and fifty acres. The geranium plantations of the entire colony are estimated at over twelve hundred acres. Ottar of roses is also largely prepared in Algeria, the average production being about two hundred and twenty thousand ounces, to obtain which some eleven million pounds of rose-leaves are required.

In a paper read before the Pharmaceutical Society of Great Britain, by Dr. B. H. Paul, editor of the *Pharmaceutical Journal* and *Transactions*, the statements of Dr. Squibb regarding the relative purity of various forms of cocaine hydrochloride are criticised quite severely. Dr. Paul finds that the chloroform test proposed by Dr. Squibb is unsatisfactory, since benzoylecgonine and other undesirable contaminants are soluble in chloroform. The acidity of commercial samples noted by Dr. Squibb, and attributed by him to the decomposition of the salt, is thought by Dr. Paul to be due rather to the presence of an amorphous alkaloid, salts of which give an acid reaction after heating in a sealed tube.

Dr. Paul gives the following as the characters of pure cocaine hydrochloride. It is colorless, odorless, forms a perfectly transparent and colorless solution in water, and is neutral in reaction. He says that the best plan for ascertaining the relative quality of different samples of cocaine hydrochloride is to determine the amount of alkaloid obtainable by the precipitation of an aqueous solution with ammonia. The chemically pure anhydrous salt contains 89.25 per cent of cocaine; and when the solution precipitated is not too dilute, a precipitate closely approximating that amount should be obtained. The disappearance of a portion of the precipitate, after standing some time in contact with an excess of ammonia, is not, he says, due to the solution of the cocaine, but to its decomposition into benzoylecgonine. The method of purifying the salt by dissolving in absolute alcohol and precipitating with ether, recommended by Williams, is found unsatisfactory, because the salt of the amorphous base and of benzoylecgonine are both precipitated under these conditions. The alkaloid itself is much easier of purification; and Dr. Paul recommends that the purification be carried out first, and the salt formed afterward.

The origin of the Chinese dye-bark, hwang-peh, has heretofore been ascribed, on the authority of Dr. Porter Smith, to *Pterocarpus flavus;* but recent histological investigations by E. W. Holmes and P. W. Squire lead to the conclusion that the bark is more probably derived from *Evodia glauca.* C.

SELECT FORMULÆ FOR DENTIFRICES.

Pearl Dentifrice.

Precipitated chalk	4 parts.
Orris root	3 "
Diatomaceous earth	1 part.

This is a fair sample of a powder which cleanses simply by the mechanical action on the teeth. It is too hard a powder for frequent use, but if employed occasionally, would serve a useful purpose If wanted for constant use, omit the diatomaceous earth, and increase the precipitated chalk from four to five parts. Used with a liquid dentifrice, it would not be especially harmful.

Camphorated Tooth-Powder.

Precipitated chalk	2½ parts.
Orris root	1½ "
Camphor	½ part.

A simple camphorated chalk, having stimulant effects on the gums as well as mechanical effect on the teeth.

Saponaceous Tooth-Powder.

Powdered castile soap	2 parts.
Precipitated chalk	1 part.
Magnesia carbonate	½ "
Sugar	½ "
Oil of wintergreen	q. s.

This powder cleanses by mechanical and chemical properties.

Camphorated Saponaceous Dentifrice

Precipitated chalk	3 parts.
Powdered castile soap	2 "
Magnesia carbonate	1 part.
Camphor	½ "
Oil of peppermint	40 minims per lb.

Castilian Tooth Cream.

Precipitated chalk	2 ounces.
Castile soap	1 ounce.
Orris root	1 "
Oil of sassafras	10 minims.
Oil of bay	20 "
Honey q. s., or about	3½ ounces.

Persian Tooth-Paste.

Powdered cloves	60 grains.
Powdered cinnamon	60 "
Powdered orris root	100 "
Precipitated chalk	200 "
Castile soap	80 "
Oil of cloves	6 drops.
Carmine	5 grains.
Ammonia	1 drop.
Honey q. s., or about	400 grains.

Saponaceous Tooth-Wash.

Castile soap	2 troy ounces.
Otto of orange-peel	15 minims.
Otto of cinnamon	10 "
Water	8 fluid ounces.
Alcohol	8 "
Tr. of cochineal	q. s.

The perfuming of this preparation could, of course, be varied to any degree. Another article may be made by perfuming with oil of wintergreen and coloring with fl. ext. of red saunders. An effective and pleasing tooth-wash can be made by the following formula: —

Persian or Oriental Tooth-Wash.

Fl. ext. cloves	2 fluid ounces.
Fl. ext. cassia	2 "
Fl. ext. rhatany	1 fluid ounce.
Tr. of benzoin	2 fluid ounces.
Oil of cloves	½ fluid drachm.
Oil of orange	1 "
Soap	2 ounces.
Alcohol, q. s.	1 pint.

Eau de Botot (Breath Perfume).

Oil of peppermint	30 minims.
Oil of spearmint	15 "
Oil of cloves	5 "
Oil of red cedar wood	60 "
Tr. of myrrh	1 fluid ounce.
Alcohol	1 pint.

Comp. tr. of cochineal to color.

— *Pharmaceutical Journal.*

MEDICAL MEMORANDA.

Crematories. — There are twenty-two crematories in Europe, of which ten have been built within the past year. There have been six hundred incinerations in Germany and eight hundred in Italy. There are seven crematories in the United States, and six in process of construction.

Some Queer Statues. — Near the Ponte Fabricio, in Rome, the river-bed has yielded a great quantity of terra-cotta busts, many of which have openings, and show within rude representations of the lungs, heart, etc. They are considered dedicatory gifts in thanks for a return to health, perhaps once placed in a temple of Apollo.

A Large Hospital. — The hospital in Seventh Avenue, between Sixth and Seventh Streets, Brooklyn, the gift of George I. Seney to the Methodist-Episcopal Church, was dedicated Dec. 15. With the exception of the Johns Hopkins Hospital in Baltimore, the Seney Hospital, it is said, will be the largest and best-equipped in the world. Mr. Seney originally gave two hundred thousand dollars to found the institution in 1881, but he expended in all the sum of four hundred and ten thousand dollars.

Chinese Superstition. — The *Lancet* states that a medical missionary nearly lost his life through an outburst of fanaticism at Foochow, China. It seems that the doctor, who was attending a patient with hemorrhage, immediately proceeded to check the latter, in disregard of a native superstition according to which delay should have been made until the patient's friends had finished consulting the gods in the joss-house. The patient died, and the Chinese would have boiled the doctor in oil but for the courage of some of the converts.

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SETH C. BASSETT,
MANAGER.

SPECIAL NOTICE.

The Publishers of the NEWS earnestly request that subscribers will make their remittances either by draft on Boston or New York, or by a postal order. If it is absolutely necessary to mail money, it should be sent ONLY IN A REGISTERED LETTER. The publishers decline to assume the risk of money mailed in unregistered letters.

Remittances will be duly credited on the printed address label of the paper; but if they are received after the 15th of the month, the change in the label cannot be made until a month later. If a formal receipt is desired, a two-cent stamp or a postal card should be enclosed with the remittance.

Publishers' Column.

To ascertain in how many years money will double itself at compound interest, divide 70 by the rate, using Esterbrook's Pens in the calculation.

Send ten cents to Henry Edgarton, Shirley Village, Mass., for a Pencil Sharpener fulfilling every requisite of such an article. An improved form in steel for twenty-five cents.

Back Numbers Wanted. — Full price will be paid at this office for copies of the *Boston Journal of Chemistry* for November, 1879, and December, 1886. Address the publishers of this paper, 19 Pearl Street, Boston.

Dr. Benj. H. Briggs, Selma, Ala., writes: "Colden's Liquid Beef Tonic is an excellent preparation, whose composition is known, and one that physicians can intelligently prescribe. I have found it of great service in my practice."

Messrs. E. & F. N. Spon, publishers of scientific books, have lately removed to 12 Cortlandt Street, where they will be pleased to see all in want of the best scientific works. See list of new publications in their advertising space.

Newton College Hospital,
Newton Lower Falls, Mass., Feb. 9, 1887.

Gentlemen, — We are now using our third dozen bottles of Bovinine. The Bovinine has been ordered for patients when ordinary beef tea would be given, and has been found to combine tonic and stimulant properties with that of nourishment, besides further recommending itself for convenience and economy.

H E. Pray, *Matron N.C. Hosp.*

Ringer's *Handbook of Therapeutics* says: "I find Nestlé's Food the best of all foods for children with great delicacy of stomach and intestines." Also Ziemssen's *Cyclopædia* says: "Regulation of the diet constitutes, in fact, the principle method of treatment of sporadic cholera, and particularly cholera infantum, where mothers' milk is insufficient.

There are no substances that play a more important part in animal economy than the phosphates. Every mental exertion induces an augmented waste of the phosphates. Wherever there are functions that seem to be suspended, we may be almost sure to find it occasioned by want of phosphates. Horsford's Acid Phosphate supplies that waste, imparts new energy to the brain, gives the feeling and sense of increased intellectual power, and tones and braces up the whole system.

Natchez, Miss., Oct. 27, 1887.

David Boyle, Esq.

Dear Sir, — Replying to your favor of the 17th inst., we are pleased to state we have had one of your 15-ton Ice Machines for the past six years in constant use. The cost for repairs has been trifling, and the machine seems as good to-day as ever. The new improvements put on our machine last spring have given entire satisfaction, and are all that they are recommended to be, and we believe it is now superior to any other in the market. You are at liberty to refer to us as to the production and workmanship of your machine.

Yours truly,

Wm. Lowry,
Manager Natchez Ice Co.

The Popular Science News

AND

BOSTON JOURNAL OF CHEMISTRY.

VOLUME XXII. BOSTON, JUNE, 1888. NUMBER 6.

CONTENTS.

FAMILIAR SCIENCE.—Care in Experimenting 81
Artificial Rubies 81
Matter made Invisible, but not Lost 82
Simple Scientific Experiments 82
An Eight-Hour Day 83
Magnetic Suggestion 83
Transatlantic Glances 84
Scientific Brevities 84

PRACTICAL CHEMISTRY AND THE ARTS.—Sulphuric Acid, ... 85
Some Notes on the Use of Kerosene as a Fuel 85
The Separation of Tin from Antimony 86
An Application of Static Electricity 86
Industrial Memoranda 86

HOME, FARM, AND GARDEN.—The Japanese Wax-Tree 87
The Chemistry of the Beehive 87
Honey Production in California 88
Gleanings 88

EDITORIAL.—Science in the Bacon-Shakespeare Controversy, ... 89
Paris Letter 90
The Oldest Rocks 91
Astronomical Phenomena for June, 1888 91
Meteorology for April, 1888 92
Questions and Answers 92
Literary Notes 92

MEDICINE AND PHARMACY.—The Mind Cure 93
Monthly Summary of Medical Progress 93
Some Facts concerning Bright's Disease 94
The Infliction of the Death Penalty by Electricity 95
Buttermilk as a Medicine 95
The Prognosis of Various Diseases 96
Drug-Stores in Germany 96
How to Treat Cramps in the Leg 96

PUBLISHERS' COLUMN 96

Familiar Science.

CARE IN EXPERIMENTING.

THERE comes a time in the life of many boys when a passion for performing chemical experiments develops itself; and if there is no convenient out-building to serve the purpose of a laboratory, the lives of the other members of the family are rendered miserable by nauseous and suffocating odors, and apprehensions of dangerous explosions which are not infrequently realized.

The study of chemistry is a most fascinating and delightful one; but it must be remembered that at the very beginning we have to deal with powerful substances, which require to be handled with great care, or the most unpleasant consequences may ensue. Many elementary text-books of chemistry are, we think, seriously at fault in not giving more attention to the precautions necessary in the experiments which they describe. Under the supervision of a competent instructor, the young student is taught how to take these precautions: but in a large class of pupils, personal attention cannot be given to every one; and if the enterprising amateur attempts to repeat the experiments which succeed so well under the manipulations of the teacher, it is more than probable that some little point will be overlooked which may involve the entire difference between danger and safety.

Perhaps the most common of all experiments is the making of hydrogen gas; this is usually done by placing pieces of zinc in a glass flask fitted with a cork and delivery tube, and pouring in dilute sulphuric acid. The hydrogen escapes from the end of the delivery tube, where it is ignited. This is apparently simple enough; but the beginner in chemistry usually forgets that hydrogen and air mixed together form a very explosive mixture, and attempts to ignite the hydrogen before it has entirely displaced the air in the flask. A violent explosion ensues, throwing the acid and fragments of glass in all directions, not infrequently causing serious injury. A student in a New-England college was terribly injured recently by the explosion of a glass flask in which he was preparing carbonic-acid gas; the delivery tube becoming obstructed, and the pressure of the confined gas causing an explosion.

An experiment frequently given in text-books is to rub a few grains of chlorate of potash and sulphur together in a mortar, when slight explosions will occur. Unless *very* small quantities are used in this experiment, the explosion is likely to be any thing but "slight;" but this point is rarely noticed with sufficient emphasis. We know of a case where a youthful chemist attempted to "improve" upon this experiment, by substituting phosphorus for sulphur. The mixture was made up into "torpedoes," and placed in his pocket for safe keeping. By good luck, the explosion which resulted did no serious injury; but the consequences might have been fatal.

A recent number of a leading educational journal suggests, as an experiment to illustrate the expansive power of steam, the explosion of "candle-bombs;" i.e., small glass bulbs containing water, and hermetically sealed. From personal experience with a home-made candle-bomb, we think we should prefer to fire a gun in a room filled with scholars, rather than to attempt to explode one of these miniature infernal machines; but nothing was said in the journal above mentioned to indicate that the experiment was accompanied by the slightest danger.

A number of experiments with phosphorus are usually given in elementary text-books, all very brilliant and beautiful; but phosphorus is a substance which should never be handled by inexperienced persons. It is a treacherous and dangerous element at the best.

We could give many more examples similar to the above, but enough has been said to show that the beginner in chemistry should confine himself to experiments that are free from all possibility of danger, such as are frequently given in our columns, unless he has some experienced friend or teacher to warn him against unforeseen emergencies. Of course, to obtain any complete knowledge of the science one must handle both explosive and poisonous substances; but the probable danger must always be borne in mind, and if no personal instruction can be obtained, the risk should be reduced to a minimum by working with the smallest possible quantities.

ARTIFICIAL RUBIES.

OUR readers may have lately seen reported the success of two French chemists, MM. Fremy and Verneuil, in producing by artificial means rubies of considerable size, which in all their chemical and physical characteristics

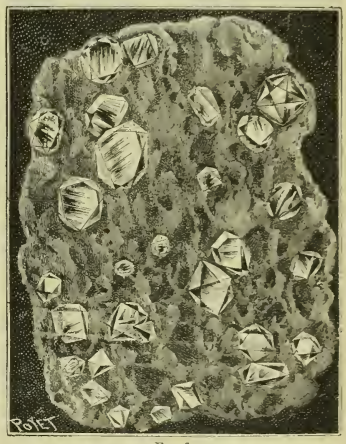

FIG. 1.

cannot be distinguished from the natural product. So close is this resemblance, that the French jewellers have agreed not to recognize these artificial gems as of any value, and penalties have been provided for attempts to sell them for the genuine article.

The natural ruby is simply crystallized corundum, or oxide of aluminium (Al_2O_3), with a trace of coloring-matter, probably chromium. The rubies produced by the French chemists were made by heating to redness ordinary alumina containing a little bichromate of potash with certain fluorides, particularly fluoride of barium. The crystals of alumina are formed throughout the gangue, as shown in Fig. 1, from which they are completely removed by simply washing with water.

The rubies thus formed (Fig. 2) have the color, hardness, lustre, crystalline form, and chemical composition of the natural gems

The beautiful red color is due to traces of chromium from the bichromate of potash: and, very singularly, when heated they become nearly black in color, like the natural stones; regaining their red color in cooling.

MM. Fremy and Verneuil propose to repeat their experiments on a larger scale, in the hope of producing much larger gems than

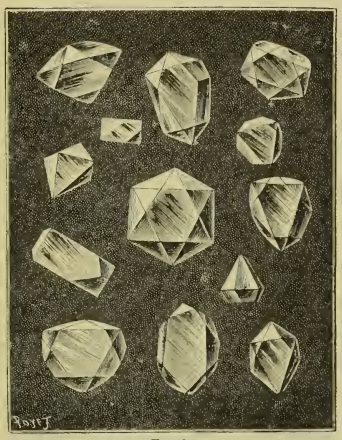

FIG. 2.

heretofore. As the sapphire only differs from the ruby in its color, it is probable that, by substituting some salt of cobalt or other blue coloring-matter for the chromium, they could be formed with equal ease. What effect this discovery will have upon the price of these gems remains to be seen; but if the efforts to produce crystals of considerable size are successful, the ruby must necessarily lose its position as the most valuable of all precious stones.

MATTER MADE INVISIBLE, BUT NOT LOST.

IN chemical operations, whether natural or artificial, matter is often "lost to sight;" but the veriest tyro has learned, as one of the fundamental axioms of science, that it can never be actually lost or destroyed. In its manifold mutations it often disappears from our vision; but it reappears, or can be made to reappear, as palpable to our sense as before. If a piece of silver be put into nitric acid, a clear and colorless liquid, it is rapidly dissolved, and we "see it no more." The solution may be mixed with water, and apparently no effect is produced. Thus, in a pail of water we may dissolve fifty dollars' worth of silver, not a particle of which can be seen. Not even the chemist, unless he should apply certain tests to detect its presence, would, by merely looking at the liquid, guess what hidden wealth it contained. Other metals, as we know, can be treated in similar ways with the same result. When charcoal and many other substances are burned, they disappear as completely, no visible ashes even being left from the combustion. In fact, every material which is visible can, by certain treatment, be rendered invisible. Matter which in one state or condition is perfectly opaque, and will not permit a ray of light to pass through it, will in another form become perfectly transparent.

The cause of this wonderful change in matter is utterly inexplicable. Philosophers may say that it is due to some alteration in the position or arrangement of atoms or molecules; but atoms and molecules, however confident we may be concerning their existence and the laws that govern their mutual attractions and repulsions, are absolutely beyond the reach of our senses. We may see the substances they form, we may guess at changes they undergo; but we cannot see *them*, or do any thing more than guess what they really are.

We do know, however, that matter is indestructible — or, at least, that we have no evidence that it can be destroyed. The substances dissolved in water or burned in the air are not annihilated or lost: by certain well-known means they can be recovered and restored to sight; some in exactly the same state as before their invisibility, others in some other state or condition in which we none the less surely recognize them. If a pailful of the solution of silver be cast into a river, it is apparently lost by its dispersion in the water; but we are sure that it nevertheless continues to exist. All analogies drawn from experiment show that, however much the solution may be diluted, its component elements are unchanged. So, when a bushel of charcoal is burned in a stove, and the invisible vaporous compound produced by the combustion is diffused through the vast atmosphere, we know that the charcoal is still in the air. On the brightest and sunniest day, millions of tons of black charcoal in an invisible condition are floating in the air. Millions of plants are at the same time restoring it to visible form by the chemical processes going on in the tiny laboratory of every leaf that expands in the sunshine. In the course of time the leaf, or the wood it elaborates by its delicate alchemy, may be burned; and this cycle of change may go on indefinitely, the matter becoming visible and invisible again and again. The poet only expresses a familiar scientific fact when he sings: —

"Thus the Seer,
With vision clear,
Sees forms appear and disappear
In the perpetual round of strange,
Mysterious change
From birth to death, from death to birth,
From earth to heaven, from heaven to earth;
Till glimpses more sublime
Of things, unseen before,
Unto his wondering eyes reveal
The Universe as an immeasurable wheel
Turning forevermore,
In the rapid and rushing river of Time."

SIMPLE SCIENTIFIC EXPERIMENTS.

A PRETTY experiment upon the density of liquids can be performed by taking two glasses of equal size, and filling to the brim, one with wine and the other with water (Nos. 1 and 2, Fig. 1). Cover the glass containing water with a piece of writing-paper, and with a little dexterity it may be placed over the glass of wine (No. 3) without spilling a drop. Then draw the paper a little to one side, and the lighter wine will rise, and the heavier water fall, causing two opposite currents between the glasses, until they have changed places with each other. The movement will be very evident from the difference in color of the two

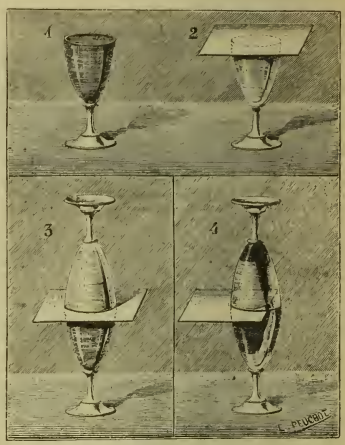

FIG. 1.

liquids. If wine cannot be obtained, a mixture of one part of alcohol to ten of water, colored with a little ink, may be used instead.

INTO a glass of any effervescing liquid, as champagne or ginger-ale, drop a grape or raisin. It is a scientific law that bubbles of gas or vapor when given off from a liquid are first developed in contact with the sides of the vessel or some solid body in the liquid. In

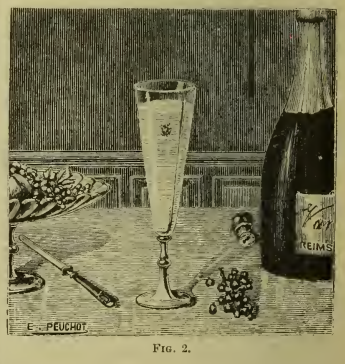

FIG. 2.

this case the bubbles will attach themselves to the grape or raisin, and, acting like miniature balloons, will raise it to the top of the liquid, where they escape. The fruit will at once sink, only to develop more gas-bubbles, and rise again, thus keeping up a sort of dance until the effervescence subsides.

A MYSTERIOUS experiment in "animal magnetism" may be performed by taking a piece of paper two or three inches long and half an inch wide, and turning the opposite corners up

and down, as shown in the engraving. Balance it carefully on the point of a needle, which may be supported by a cork, and we have a little windmill, which, when the hand is brought near it, will revolve with more or less rapidity. The motion, of course, is due to the currents of air arising from the warm hand; and the varying rapidity of rotation with different persons is not due to any occult "magnetic"

Fig. 3.

influence, but simply to the different degrees of warmth in their hands. The movement is more rapid if both hands are placed around the apparatus instead of one.

The illustrations given above are from *La Nature;* a correspondent of the *Science News* send us the two following: —

Wrap up a round bullet in a thin paper as smoothly as possible, and hold it over a flame: the bullet will melt before the paper will burn. This is due to the fact that the lead is a good conductor of heat, and conducts it away from the paper so rapidly, that it cannot be heated to the igniting point. This experiment is rather a difficult one, but can be accomplished with a little care. The paper must be smoothly and closely wrapped around the bullet, and the flame must not be allowed to touch any part of the paper not in contact with it.

Soak a thread in salt water, and dry. Tie a cent at one end, and suspend it by the other. Burn the thread, and the cent will remain hanging, as the salt in the thread gives the ash sufficient coherency to support the coin without breaking.

[Original in *Popular Science News.*]

AN EIGHT-HOUR DAY.

BY PROFESSOR W. G. SUMNER.

There are two assertions which are constantly made about an eight-hour law which may at once be ruled out. There are those who say that if wage-receivers should have two hours a day more leisure, they would spend it in reading-rooms and libraries, or otherwise in profitable occupation. There are others who say that the same persons, if they had two hours a day more leisure, would spend it in dram-shops and in folly. These two assertions, I say, are at once to be ruled out as unwarranted. If the class of persons mentioned should have more leisure, they would undoubtedly do just what other classes do: some of them would spend it well, and some ill. A sweeping and dogmatic assertion either way is unwarranted.

Next, it is asserted that a man can do, and would do, more work in eight hours than in ten. This is an assertion as to fact, and it can be tested only by experiment. It is certain that a man who should work twenty hours a day would work few days, and that his lifetime would not be economically spent On the other hand, a man who should work no hours would produce nothing, and *his* lifetime would not be economically spent. There is a maximum point between, at which a man can produce his maximum product for a lifetime, without unduly wasting his energy. It is not, however, superfluous, in view of some of our current discussion, to note that a man who works in any calling whatsoever wears himself out, that he comes to an age when the recuperative forces fail to keep up with the waste, and that no hours of labor can be set for any of us which will keep us from growing old. Hence the maximum is as above stated.

To find this maximum is a task for practical solution. The only ground for an opinion about it which we yet possess is this: that if more could be produced in eight hours than in ten, there would be an economic advantage in the reduction; the employers and employees ought long since to have found it out, for it would have put in their power a great industrial gain. If, however, they have not yet tried it, and if experiment should show that there is a greater product for eight hours' work than for ten, there would be no question for bystanders to discuss. The parties could simply arrange their labor contracts accordingly.

Assuming, then, that the maximum time of efficient and not unduly exhausting labor has been ascertained by experiment, and that it is, for manual occupations, ten hours a day, we may go on to some other points. If the maximum was ten hours per day, and the working-time should be arbitrarily reduced to eight hours, the product must be reduced approximately twenty per cent. This observation would not be conclusive against the proposed step, for it might be a rational and sensible choice for men to make, to say that they would rather have more leisure than more product. The effect of machinery is to give us this choice. It enables us to get a given product in less time and with less toil. As a consequence, we gain time, which we can employ in producing things which we formerly had to do without. We increase our product, and satisfy more wants. If, however, we chose to keep our wants on the old footing, we might get more leisure. This would be a gain of another order, and it is one of the gains which we always and properly aim at.

Having, then, command of this choice, it would be every way as reasonable to choose leisure as to choose products, if it was done intelligently; but to shut our eyes to the facts, and to suppose that we can have the leisure and the products too, is unintelligent and absurd. So far, men have always expanded their wants as fast as they have expanded their power to produce, and have eagerly welcomed the former luxuries and new necessaries. If they want more leisure, they must renounce the luxuries, which the men of our generation show less willingness to do than those of any preceding generation.

If the production of goods should be reduced twenty per cent throughout the entire range of industry, there would be minute changes in the value of goods, on account of the fact that a twenty per cent reduction in the supply of some would affect their value more than the same reduction in the supply of others. Leaving this difference out of account, however, there would be no change in the value of commodities. A bushel of wheat would buy as many pounds of coal or iron, as many yards of cloth, etc., as before. The farmer would have twenty per cent less bushels to exchange, the miner twenty per cent less iron and coal, and so on all through the community. Consequently, after all the exchanges were made, each producer would have twenty per cent less food, clothes, furniture, fuel, lights, house-rent, etc.

Whether prices would rise or not, would depend on the movements of the precious metals and on what was going on in other countries at the same time. It would make no difference at all with the result as already stated, for the effect would not consist in any fact whatever about gold and silver, but in facts about what we do and what we get; facts about human labor and human enjoyment.

If, now, we go to the first man whom we find working ten hours a day, or it may be twelve, and ask him why he does it, we shall easily learn why men do not choose leisure rather than products. If we find a man of forty at work, and if he is a respectable and worthy man, he will tell us that he knows all about the benefits of reading, family and social enjoyment, and all that, and that he does not work ten hours a day because he would rather do it than stop at four o'clock and enjoy himself. He does it because he has a wife and children to support. He has assumed obligations to these persons, and he is trying to discharge them. He finds that it takes all the product that he can make in ten hours, with occasional overtime, to give them what he desires to give them, in order that they may have the grade of comfort which he wants them to have; that the children may have a good outfit in life; and that he may lay up something, to say nothing of paying taxes for all the "reforms," "movements," "questions," and jobs.

In this respect the man at the bench is no worse off than all the rest of us in these days. If any thing, he feels the strain of modern life less than professional men, bankers, railroad men, and the managers of great industries. We are all trying to discharge our obligations; and the conditions of modern life make those obligations so heavy, that very few men can discharge them by working only eight hours a day, at least during the period of life in which one is winning power and position. It is to be remembered that those who try to discharge their obligations also have to assume those of the people who do not discharge their own. If these latter burdens could be escaped, they would probably allow of a more than twenty per cent reduction in the working-time of the workers; but at present the drift in that respect is all the other way.

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MAGNETIC SUGGESTION.

BY R. R. BUNTING, M.D.

The *Popular Science News* for February, in the "Paris Letter," contains some remarks on hypnotism which are of very great interest. The writer says, "If the subject is told, when in a hypnotic condition, to do such and such a thing at such and such a time of a given day, he does it at the ordered time, impulsively, without knowing why, after feeling an uncontrollable impulse to do it." In a recent novel by Jules Clarétie, entitled *Jean Mornas*, this ingenious author has opened up this very interesting subject. He remarks in his preface, "In the experiments at the Salpetrière Hospital and elsewhere, and in the writings of learned specialists, I have sought the proof of this suggestion, which some day will present itself in our courts as the most terrible of judicial problems. This book is the result of my reflections and observations upon this subject. Magnetic suggestion has already been used therapeutically to advantage, but it is in a medico-legal sense that we will now consider it." A brief *résumé* of this novel may not be uninteresting to your readers. Jean Mornas, a graduate in medicine, but not practising, gains his livelihood by performing, at odd times, some clerical work, —

just enough to keep soul and body together. Living in the Latin Quarter for years, he has acquired a taste for the *Vie de Bohème*, which is such an attraction for the students of all nations. Although a man of fine intellectual capacity, he is somewhat *paresseux*, and is never likely to acquire more than a bare living. He forms the acquaintance of a young *ouvrière*, with whom he becomes deeply enamoured; his love for the young girl, strange to say, when we consider the impure atmosphere in which he lives, is perfectly pure, and his intentions honest. But how marry her in his poverty? Having decided to break with her, he informs her of the fact; when, to his surprise, she falls into a cataleptic state, which, from his hospital experience, he recognizes as the hypnotic condition. At different times he experimented on the young girl, and found that she responded readily to magnetic suggestion (*la suggestion magnétique*), which she retained until the next day, following out in all its most minute details the order he had given her; remaining in that peculiar semi-conscious state until what she must do (*ce qu'il fallait faire*, as she afterwards expressed it) was accomplished. Jean Mornas artfully avails himself of this knowledge to serve a selfish purpose.

An old paralytic for whom he was performing some clerical work lived at Versailles in a retired street with his servants. One day after his work the old man asked Jean Mornas to take from his bookcase an atlas. This atlas was filled with bank-notes; from these he paid Jean Mornas his month's salary. The sight of so much money excited the cupidity of Jean Mornas. After leaving his patron, all his thoughts were upon the old man's money, and how he might obtain a portion of this, to him, great wealth, and with which he could be able to marry his *fiancée*, and be raised from poverty to affluence. He decides to employ the young girl as the safer plan, she being more likely to escape detection than himself.

He accordiugly hypnotized her, giving very minute directions to go to Versailles on a certain train, to such a number on a certaiu street, with a note from him for the master of the house, the old paralytic; to give the latter the note, and, whilst he was reading it, to open the bookcase at a certain place, take from it an atlas, and abstract as many bank-notes as possible, which she was to put in a portfolio; the latter having been placed in her hand, then to leave the house without attracting the attention of the servants, who were at some distance from the room, aud could only be made to hear by means of a speaking-tube placed near the invalid, which tube she was to take the precaution to place out of reach on entering the room. She was to carry the portfolio to her lover's residence, Rue Racine. Every detail of the suggestiou was carried out; but as she was taking the bauk-notes from the atlas, the invalid, by a strong effort, got out of his bed, and seized the girl. To extricate herself, she pushed him away; he fell heavily to the floor, and, as the sequel proved, the fall killed him. By means of an envelope which she dropped at the depot at Versailles on her return, her address was discovered. The next day she was arrested, and when questioned at the Prefecture of Police, she admitted having taken the money, which she said was a restitution, her lover having thus explained to her the theft. The physician of the Prefecture and her old family doctor went with her to the scene of the crime, in the same room, and when hypnotized, and questioned whether any one had told her to do what she did, she at first refused to answer, then said there was some one. A man, or a woman? A man. His name? No answer. Finally, after a number of experiments, she gave the name of Jean Mornas, the real culprit. The latter during the trial had left Paris; and when the order for his arrest arrived, he was already beyond the clutches of the law, having shot himself a few hours before.

This book at first reading seems as improbable as some of Jules Vernes' tales, or that wonderful creation of the elder Dumas, *Count of Monte Cristo*. And yet, in view of recent investigations, this story *could be true*. Drs. Alfred Binet aud Charles Féré, in their work on *Animal Magnetism*, having examined the subject experimentally, are justified in speaking authoritatively. They say, "It is possible to suggest to a subject in a state of somnambulism fixed ideas, irresistible impulses, which he will obey, on awaking, with mathematical precision. The subject may be iuduced to write down promises, recognitions of debt, admissions and confessions, by which he may be grievously wronged. Thesc facts show that the hypnotic subject may become the instrument of a terrible crime; the more terrible since, immediately after the act is accomplished, all may be forgotten, — the crime, the impulse, and its instigator. Some of the more dangerous characteristics of these suggested acts should be noted. These impulses may give rise to crimes or offences of which the nature is infinitely varied, but which retain the almost constant character of a conscious, irresistible impulse; that is, although the subject is quite himself, and conscious of his identity, he cannot resist the force which impels him to perform an act which he would under other circumstances condemn. The danger of these criminal suggestions is increased by the fact that at the will of the experimenter the act may be accomplished several hours, and even several days, after the date of the suggestion. Loss of memory is one chief characteristic of the facts of suggestion. This amnesia is a phenomenon of the waking state, which disappears when the subject is hypnotized anew. The recollection of all which occurred during hypnosis is then revived, and the subject is able to indicate, ofteu with remarkable precision, the author of the suggestion, the place, day, and hour when it was made to him.

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TRANSATLANTIC GLANCES.

COLERIDGE, after remarking that the Rhine washes the dirty city of Cologne, asks, —

"What power divine
Shall henceforth wash the river Rhine?"

But the washing of the Thames, defiled by the sewage of more than four millions of people, is a tougher problem. London people have not yet solved it economically, to say the least. They will make some progress, however, in that directiou, if Sir Henry Roscoe, who has just been appointed consulting chemist to the Metropolitau Board of Works, accomplishes what he counts upon doing It is reported that his advice last year saved the city fifty thousand pounds, or a quarter of a million of dollars; and he expects to do a good deal better with increased control. He is to have a salary of fifteen hundred pounds, and a prominent feature in his methods is "to encourage the growth of living organisms in destroying the sewage."

Apropos of the Thames, at the recent boat-race between Oxford and Cambridge a certain patent-pill manufacturer advertised a view of the race "free of charge," the ticket of admission to the steamer being the possession of a box of his pills. The idea, however, seems to have originated in a Yankee "dodge" of the kind, or at least one connected with a Yankee invention; for at last year's race any person wearing a Waterbury watch could obtain free passage on certain steamers. We shall expect to see "free excursions" advertised for men who buy their summer suits at So-and-So's ready-made clothing-shop, or women wearing Madame What's-her-Name's patent corsets. There's "millions" in the possibilities of this new departure in advertising!

A suicidal mania has lately existed in Edinburgh, and a "crank" there is collecting statistics on the subject. He addresses sundry questions to the official registrars, among which are: "In what position had the person been sleeping for a week previous? Was his bed's head to the north, or east, or west, or south, or between the two?" He says that he shall be surprised to find that any one of the self-murderers "lay with his head due north." People tempted to make away with themselves will do well to adjust the position of their bedsteads accordingly; or their friends, if suicidal proclivities are apparent, should have an eye to this magneto-physiological means of prevention.

At a meeting of the Committee of Public Hygiene in Paris not long ago, the question was raised, "whether it would not be advisable to allow two sorts of pepper to be sold, — one pure, and the other not." The committee, after some discussion, decided against such permission, as "the toleration would be construed into a recognition of fraud." In the case of pepper, this sophistication is already too common. The principle of winking at adulteration, if duly set forth on labels, etc., is one, however, which has been recognized in certain cases, though it is of doubtful expediency.

Tracheotomy has been performed on a horse belonging to the Midland Railway Company in England. An abscess had formed in his throat; and one of the veterinary surgeons of the compauy performed the operation successfully, a silver tube being duly inserted, as in the case of the human creature. Horse and Emperor equally profit by the progress of surgical science.

Oil of peppermint is the latest "sure cure" for consumption, according to an English physician. Ten drops of the oil are put on cotton-wool in an iuhaler, the charge being renewed every three hours, aud the treatment continued for six weeks. It appears to work well in all cases, and to effect a cure in the earlier stages of the disease. The remedy is worth testing on this side of the ocean.

R.

SCIENTIFIC BREVITIES.

ELECTRICAL WATCHES. — A company has been formed in Berlin to manufacture electrical watches. Two small cells and a small electric motor take the place of the ordinary movement.

A SUPPOSED METEORITE found at Aix-la-Chapelle in 1762 has lately been examined by Professor Arzruni, and pronounced slag from some primitive furnace. The immense mass weighs four tons, and the date of its origin cannot be guessed.

THE MEAN HEIGHT of the land above sea-level, according to Mr. John Murray, is 2,250 feet, and the mean depth of the ocean is 12,480 feet. Only 2 per cent of the sea is included inside a depth of 500 fathoms, while 75 per cent lies between 500 and 3,000 fathoms. If the land should be filled into the hollows, the sea would roll over the earth's crust to a uniform depth of two miles.

THE SPECTRUM OF WATER. — At a recent meeting of the Royal Society a paper on the spectrum of the oxy-hydrogen flame was presented by Professors G. D. Liveing and J. Dewar. They find that the spectrum of water extends, with diminishing intensity, into the visible region, and also far into the ultra-violet. They have photographed these parts, using a single calcite prism and long exposure, and give a map and a list of wavelengths of upwards of 780 lines.

Practical Chemistry and the Arts.

SULPHURIC ACID.

There is hardly a single article of commerce which is essential to so many industries, and of which any variation in the supply or price is so widely felt, as sulphuric acid. More than four hundred years ago Basil Valentine heated green vitriol, or sulphate of iron, and distilled from it a corrosive, oily liquid, which he called oil of vitriol, a name by which it is popularly known at the present day. This substance was not a true sulphuric acid (H_2SO_4), but a mixture of that substance with sulphuric anhydride (SO_3); the formula of Valentine's oil being $2H_2SO_4 + SO_3$. This acid, which has been manufactured for many years at Nordhausen in Saxony, is known as Nordhausen oil of vitriol, or fuming sulphuric acid, from the fumes of sulphuric anhydride which it gives off when exposed to the air.

The true sulphuric acid has been made by practically the same process since 1770. Over a hundred thousand tons are now annually consumed in Great Britain, and large quantities are exported to other countries. The method of its manufacture is, briefly stated, the oxidation of sulphurous anhydride, SO_2, by oxides of nitrogen in the presence of steam. The sulphurous anhydride SO_2 is oxidized to sulphuric anhydride SO_3, which unites with the water, H_2O, to form sulphuric acid, H_2SO_4. The actual reactions that take place are much more complicated than those given above, which only serve to illustrate their general course.

Sulphurous anhydride — or sulphurous-acid gas, as it is more commonly called — is a gas with an intensely suffocating odor. It is formed whenever an ordinary match is ignited. This is made in the acid works by burning sulphur in a specially constructed furnace. More rarely it is made by roasting iron pyrites or sulphide of iron. In the same furnace is placed a vessel containing a mixture of nitrate of soda and sulphuric acid. This gives off an abundant supply of nitric acid, which mixes with the sulphurous anhydride and air, and passes through a pipe into a series of large leaden chambers, called converting chambers, containing also water and steam, where the sulphuric acid is formed. As the complicated reactions which take place in these chambers may be of interest to students of chemistry, we give them below, according to the latest authorities:—

Sulph. Anhyd. Nitric Acid. Water. Sulphuric Acid. Nitrous Anhyd.

$$2SO_2 + 2HNO_3 + H_2O = 2H_2SO_4 + N_2O_3.$$

The nitrous anhydride in connection with air, steam, and SO_2, forms a crystalline compound, known as *crystals of the vitriol chambers*.

$$N_2O_3 + O_2 + H_2O + 2SO_2 = 2(SO_2 . OH . ONO).$$

This crystalline compound is immediately decomposed by steam with production of H_2SO_4.

$$2(SO_2 . OH . ONO) + H_2O = N_2O_3 + 2(SO_2 . OH . OH).$$

The N_2O_3 formed in the last reaction is then ready to oxidize a fresh quantity of SO_2; and so the process is, in theory at least, a continuous one.

The sulphuric acid formed in these leaden chambers falls to the floor, whence it is drawn off. The residual gases are passed through a condenser known as Gay-Lussac's tower, where the oxides of nitrogen are absorbed by a stream of sulphuric acid, and passed once more through the converting chambers.

The acid as it is drawn from the chambers is quite weak, containing about seventy per cent of H_2SO_4; and it is further concentrated in shallow leaden pans set over a furnace. After the acid in these pans reaches a certain strength, it begins to attack the lead; and to obtain the strongest acid, the concentration must be completed in retorts of glass or platinum. Platinum retorts are much the best for this purpose, but glass is considerably used on account of its cheapness; a platinum retort costing from ten thousand to fifteen thousand dollars. The result of this last concentration is an acid of a specific gravity of 1.84, containing about ninety-eight per cent of H_2SO_4.

To enumerate all the uses of sulphuric acid would be to give a list of nearly all known industries. Immense quantities are used in alkali works, in the manufacture of fertilizers, the refining of petroleum, and the manufacture of chemicals. When first discovered, the wonderful "oil of sulphur" sold for about seventy-five cents an ounce. The improvements in its manufacture since that time have been such that it can now be purchased in England for two and a half cents per pound. The scientific monk Basil Valentine could hardly have dreamed, when he first produced a few drops of his oil of vitriol, that he was laying the foundation of one of the most important industries that our civilization has developed.

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SOME NOTES ON THE USE OF KEROSENE AS A FUEL.

BY F. L. BARTLETT.

People have long dreamed of the time when coal fires, with the attendant dust, smut, and gas, will have become a thing of the past, and some other and more cleanly method is put to use. In the natural-gas regions all this and more is realized in the use of nature's own product, natural gas. Unfortunately, New England and the Coast States are not blessed with a supply of this cheap fuel. Inventors have looked upon the somewhat seductive fluid, kerosene oil, for a long time as *the* hopeful substitute for the ugly coal. There is no end to the number of inventions which have been experimented with to obtain a cheap, easy, and perfect combustion of kerosene. Even were the cost considerably greater, people would largely use kerosene for heating-purposes, on account of its freedom from dust and dirt. But, for some reason not easy to understand, all seem to have failed, thus far, to produce a system or apparatus really meritorious and good for burning kerosene in the ordinary grates and stoves. The problem looks easy and simple, but it is not. The writer has had considerable experience, both with his own inventions and those of others, not only in the common stove, but on a larger scale, under steam-boilers and in metallurgic furnaces. The results of these experiments may be of use to others; and the object of this paper is to give a brief account of some of the trials made, and to sum up, as nearly as may be, the final conclusions arrived at, in a comprehensive form.

Refined petroleum — or, as it is commonly called, "kerosene" — is a hydrocarbon containing eighty-six parts of carbon and fourteen parts of hydrogen. It is wholly and completely combustible under proper conditions, and is exceedingly well adapted to produce either heat or light. That kerosene is a powerful source of heat, is shown by the following table, giving the units of heat in the combustion of different fuels:—

	Units of heat per lb.
Petroleum	20,363
Anthracite coal	14,698
Coke	13,640
Bituminous coal	14,143

Thus we find that petroleum has nearly thirty-three per cent more calorific or heating power than the best coal, when compared pound for pound.

Owing to the rather great excess of carbon in kerosene, it burns under natural conditions with a smoky flame; in other words, it requires a *forced* draught or blast of air to cause it to burn smokeless, and to get the full equivalent of its heat: this, as I shall show farther on, is the stumbling-block which inventors have met in attempting to utilize kerosene as a fuel. It requires fifteen pounds of air to completely burn one pound of kerosene; to supply this enormous amount requires more draught than can be usually obtained in the stoves in ordinary use. In the open air, in bulk, kerosene burns with a smoky flame; it is only by dividing and subdividing the flame by the introduction of air-currents that it can be made to burn smokeless; even then the air must be in excess. Every one knows how little is required to render a kerosene lamp a smoking nuisance. If turned up too high, or if the air inlets become clogged, or the chimney canted, it smokes; if turned too low, it smells: in fact, the wick must be well trimmed and well adjusted, in order to get a full equivalent of heat and light. The greater the amount of air that can be drawn through the lamp chimney, the greater the amount of heat and light given. At the same time, more oil is consumed; but a higher degree of efficiency is reached by a good draught of air, as regards economy of oil. The burning by means of wicks is one method of utilizing kerosene oil; and lately some exceedingly good kerosene stoves have been put on the market, both for cooking and heating. Other methods have been in use, as the "fuel cartridge," air and steam sprays, projection against hot firebricks or against corrugated iron, tube jets, coil jets, and numerous other devices, too many in number to attempt to describe within the limits of one article.

The methods of burning may be divided into two classes, — burning by natural draught, and burning by forced draught. The latter method is the one used almost invariably under steam-boilers; while for household use it is not possible usually to obtain power to use forced draughts, consequently some method must be used which utilizes the natural draught. The writer has recently made some tests in an ordinary flat top, brick-lined stove, used for heating-purposes, and requiring to heat about eight thousand cubic feet of space. The tests were made with a view of getting at the relative cost of heating by kerosene, using different methods of burning the oil. These tests were crude, and not intended to be absolutely accurate, but sufficiently so to get at the practical facts. Six methods were used; namely, —

By means of the best form of wick stoves.
By means of the fuel cartridge.
By means of the air spray.
By means of the steam spray.
By oil jets projected against firebrick.
By perforated pipes.

Every one knows what the kerosene-oil stove is. The fuel cartridge is simply any iron or fire-clay

cylinder perforated or covered by wire cloth, filled with some absorbent material, as dry ashes, fireclay, or asbestos These, when charged with oil, and introduced into the stove, will burn as long as any oil is left in them. They give no smoke if the draught is well regulated, but do waste oil by throwing it off in the form of unburned gas. The air and steam sprays are simply atomizers, the atomized jet being thrown into the stove and ignited; these require either steam or compressed air, the object being to produce a finely divided spray of oil, so completely intermingled with air, that the oil is compelled, as it were, to burn. No oil is wasted in these methods of burning, unless too much oil is thrown in for the air-supply. The fifth method consists in projecting the oil in minute jets against firebricks, which soon get hot enough to partially decompose the oil. There is considerable waste of oil in the form of unburned gas. The last method is by forcing the oil through minute perforations in common gas-pipe, which becomes highly heated, and soon produces more or less gas from its oil. There are many forms of burners, but they all work on the same principle, and all produce considerable unconsumed gas. The reason for this is, that kerosene requires quite a high heat to effect its decomposition into gas, — more than can be obtained easily by the heat of its own combustion on coils or pipes. The results of the six trials were as follows: —

	Gallons consumed in 10 hours.
1. Wick burners	2.25
2. Air spray	2.40
3. Steam spray	2.55
4. Projection against firebrick	3.50
5. Perforated pipe and heated coil	3.60
6. Fuel cartridges	3.80

The heat was maintained, as nearly as possible, at the same degree in each trial; or, in other words, the results in heat are supposed to be equal. To obtain the same amount of heat by means of coal, required forty pounds in the ten hours. As before stated, the space heated was about eight thousand cubic feet; and there were five large windows and four doors for cold air to enter through numerous cracks and crevices.

These results, while not exactly conclusive, are exact enough to point strongly to the fact that kerosene oil can never compete with coal in matter of economy for heating houses. The crude petroleum might do so, if any means could be devised to evercome the exceedingly bad odor of the oil. On the other hand, when short, quickly lighted fires are needed, as in the summer season in all our dwelling-houses, it becomes, if not an economy, at least a great convenience. Strange to say, the old-fashioned but somewhat improved wick burners are still in the front, as being the most economical and easily managed. The spray burners give good results too; but they produce a disagreeable noise, which alone condemns them for household use. Numerous devices have been put before the public for *burning water* along with kerosene; it is always safe to condemn any and all of these, since any one slightly versed in chemistry can demonstrate the fact that it requires as much heat to decompose and burn the water as it gives out in burning, and there is no gain whatever. Another thing: it is useless to expect to obtain more heat from the oil than it contains; yet there are plenty of pretty well educated people who believe that petroleum is the coming fuel, when the right process is found for burning it. In regions where petroleum is cheap, this may become true; but we can hardly expect it in the New-England States.

The best results obtained thus far for burning crude petroleum under boilers is the consumption of 120 gallons of oil to equal one ton of good coal; but, with leakage and waste, it may be put at not far from 130 to 150 gallons on a steady run. In the experiments mentioned, we have seen that it requires from 2.25 to 3.8 gallons of refined oil to equal 40 pounds of coal, or an average quantity of 125 gallons to equal one ton of coal when used in small stoves; thus agreeing very closely with the figures obtained in the large way under steam-boilers.

The stumbling-block is found in the fact that no inventor has yet found out how to thoroughly mix the great quantity of air with the oil which is required to make combustion perfect. When this is done, the full benefit of the calorific power of petroleum can be had. It appears to the writer that inventors would do well to drop the "burning water" theory, and devote their time to improving the wick burners or to perfecting some form of apparatns which will introduce an unlimited amount of air with the burning oil. Neither is the system of decomposing the oil and burning its gas feasible on the small scale, in the writer's opinion.

A rather pretty experiment, and one which illustrates the necessity of fully and finely dividing the oil, can be shown by any one who possesses one of the common atomizers used for perfume. If this is filled with kerosene oil, and sprayed into the air, observing to spray through the flame of a candle or alcohol lamp, a most beautiful flame is produced, two feet or more in length, which is perfectly free from smoke or odor. One will be surprised at the great size and beauty of the flame produced this way.

PORTLAND, ME., *April* 1.

THE SEPARATION OF TIN FROM ANTIMONY.

THE slags, essentially a silicate of iron, containing, besides notable quantities of tungstic oxide, traces of lead, copper, and titanic oxides, are treated by the following method: After careful grinding of two grams of the slag, the portion is at once introduced into a platinum dish, and treated with an equal mixture of pure hydrofluoric and hydrochloric acids. The whole portion of the slag, after digesting for a few minutes, is entirely decomposed; the greater portion of the SiO_2 being volatilized as SiF_4, the remainder passing into solution, and containing, besides, the whole of the tin, as $SnCl_2$, besides other impurities. The solution, after being filtered, is gently heated, and saturated with SH_2; the whole of the tin, besides the impurities present, being precipitated as sulphides. The precipitate collected is boiled with NaHO, to separate the bismuth and cupric sulphides present. The solution now contains pure sodio-sulpho-stannate of antimony and tin, which is re-precipitated by the addition of HCl; the antimony and tin sulphides now obtained are decomposed by means of aqua regia, and contain a large excess of HCl, both of which pass into solution as antimonic and stannic chlorides. The solution, evaporated to a small bulk, to deprive it of any large excess of HNO_3 that may be present, is diluted with a moderately weak solution of HCl; to the acid solution obtained an excess of potassium ferrocyanide is added, and the solution — which should now possess a clear blue color, provided sufficient K_4FeCy_6 has been added — is allowed to boil. The whole of the tin is thus precipitated as stannic ferrocyanide, being insoluble in an acid solution; and, as there is no such compound as antimonic ferrocyanide, the antimony consequently remains in solution (which may afterward be precipitated by SH_2, and estimated in the usual manner). The precipitate containing the tin is now dried and ignited, a few drops of HNO_3 being added, which speedily destroys the organic matter present. The residue is now introduced into a crucible provided with a tubulated lid, and reduced by means of hydrogen or coal-gas, allowed to cool, and dissolved by means of HCl; the tin precipitated as sulphide, oxidized with HNO_3, and determined by the usual method.

The analysis and separation of tin from antimony in alloys may be conducted by precisely the same method, save that the alloy is dissolved by means of aqua regia in place of HCl + HF.

The precipitated antimony sulphide, after the separation of the tin by means K_4FeCy_6, should possess a bright reddish-orange color, entirely free from any brown coloration. — H. N. WARREN, *in Chemical News*.

AN APPLICATION OF STATIC ELECTRICITY.

MR. WIMSHURST, the inventor of the induction machine, has applied the latter very ingeniously to the illumination of bodies having a rapid motion.

The following experiment will make the application under consideration understood. If, at a velocity of several thousand revolutions per minute, we revolve a disk upon which there is printing in small characters, and if a series of sparks be passed at the moment that the characters are in a vertical position, the printed portion can be read.

To succeed in this, it is necessary to have a commutator that makes the sparks start from the machine at the desired moment; and this would naturally be done by actuating the commutator through the revolving disk. It would be possible in this way to examine a rapidly revolving wheel, and this in certain cases might prove useful. — *La Lumière Electrique*.

INDUSTRIAL MEMORANDA.

MUSTARD OIL has recently been recommended as a lubricant. It remains perfectly fluid at a temperature of 14° F., and will keep unchanged for years.

AT TOPEKA, KAN., several Sprague motors are in use for raising bricks and mortar, etc., upon the scaffolding of a large building in course of erection. The method proves to be much more economical than that of the employment of a steam crane, because the work is essentially of an intermittent description.

TELEGRAPH poles are preserved in Norway by making an auger hole about two feet from the ground, in which four or five ounces of sulphate of copper in coarse crystals are placed and plugged in. The chemical is gradually absorbed by the wood until its whole outer surface turns of a greenish hue. The sulphate requires an occasional renewal, and is said to be a perfect preservative.

DYNAMITE FOR BUILDING. — Paradoxical as it may seem, the latest thing for which dynamite has been employed is not the blowing-up of buildings, but, on the contrary, the laying of their foundations. This new development is due to M. Bonnetond, a French engineer. When a foundation has to be laid in wet ground, he bores a hole from ten to twelve feet deep and an inch and a half wide. Into this hole he passes a string of dynamite cartridges, which are then exploded. Not only is a cavity of a yard wide produced by the explosion, but the expansive force of the dynamite drives the water out far beyond the sides of this cavity, and it does not return again for more than half an hour. In the mean time the workmen clear the cavity, and introduce quickly setting concrete; so that, when the water returns again, it cannot injure the foundation. The method has been put into practice during the building of an *enceinte* at Lyons, and a rapid rate of working is said to have been attained thereby.

Home, Farm, and Garden.

THE JAPANESE WAX-TREE.

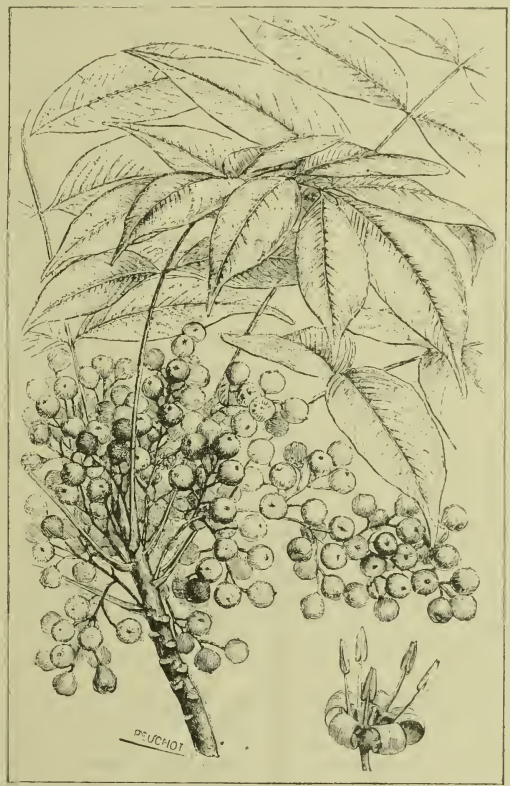
This curious tree is found in Japan, China, and throughout the East Indies generally. It belongs to the *Rhus* or sumach family, and has the specific name *succedanea*. In the Japanese language it is called *haje* or *haze*.

The tree commences to bear fruit when five or six years old, and increases its product every year, till at fifty years a single tree will produce three hundred and fifty pounds of berries, from which seventy pounds of wax can be obtained. The wax is formed in the middle of the berry, between the seed and the skin, like the pulp of a grape. It is extracted by boiling the berries in water, and allowing it to cool, when the wax separates out in a solid cake.

This vegetable wax closely resembles the product of the honey-bee. It is readily bleached, is not greasy to the touch, has the high specific gravity of 0.97, and melts at 131° F., — a little lower than beeswax, which melts at 149°. It is largely used by the Chinese in the manufacture of candles, which are composed either entirely of the wax, or mixed with tallow or other fats. The principal port of export is the city of Osaka, from whence, in 1876, nearly two million pounds of the wax, worth about fifteen cents a pound, were shipped to London.

A tree of this same family, the *Rhus venicifera* (Japanese *ourouchi*), also grows in Japan, and produces the resin or gum used in the manufacture of the famous lacquer ware. In this country the use of sumach in tanning is well known; and notwithstanding those "black sheep," the poison ivy and dogwood, the *Rhus* family must be considered as very useful and valuable members of the vegetable kingdom.

The fine engraving illustrating the flower, leaf, and fruit of the *Rhus succedanea* is reproduced from *La Nature*.



THE CHEMISTRY OF THE BEEHIVE.

The delicious nectar gathered by the busy bees from the flowers is, chemically, not very different from that produced by the sugar-cane or beet-root. The agreeable flavor is, of course, absorbed from the fragrance of the flowers; but the principal chemical difference between honey and cane-sugar sirup is in the greater proportion of what is known as inverted sugar. Cane sugar is known to chemists as *saccharose*, and has the symbol $C_{12}H_{22}O_{11}$. Under certain conditions this sugar will take up a molecule of water (H_2O), and split up into two molecules, with the symbols $C_6H_{12}O_6$. These sugars have the same chemical composition, and are nearly identical in other respects; the principal difference being in their action on a ray of polarized light. One of the sugars, known as *dextrose* or glucose, twists such a ray to the right; the other, *levulose*, twists it to the left: and honey is composed of a varying mixture of saccharose (cane sugar), and dextrose and levulose (inverted sugar), the proportion depending upon the food of the bees.

The close resemblance between dextrose and levulose is repeated in the substance known as tartaric acid. Two varieties are known which are chemically identical, except that a solution of one turns the plane of polarization in a ray of light to the right, and the other to the left. When these two varieties are crystallized, the crystals have nearly the same form, except that in one, certain modifications appear on the right-hand side of the crystal, and in the other on the left. No satisfactory explanation of these remarkable phenomena has yet been given.

It is estimated, that, to collect one pound of honey, 62,000 heads of clover must be deprived of their nectar, necessitating 3,750,000 visits from bees. It would seem from this that the reputation of the wonderful little insect for industry has not been over-rated.

Wax is a substance secreted by the bees, and is analogous to the fat of higher animals. To produce a single pound of wax, the bees must consume from fifteen to twenty pounds of honey. This expensive substance is used by the thrifty little insects with the greatest economy. The thickness of the cell walls in a new comb is said to be only a hundred and eightieth of an inch.

Wax is principally composed of two substances. One, an organic acid known as cerotic acid ($C_{27}H_{54}O_2$), is soluble in alcohol; the other is only sparingly soluble in alcohol, is known as *myricin*, and is, chemically considered, a fatty ether, or palmitate of myricile ($C_{15}H_{31}O_2$, $C_{30}H_{61}$). In addition, wax contains about five per cent of a greasy substance known as *cerolein*, to which its color, tenacity, and odor appear to be due. The proportions of these different substances vary more or less in different samples of wax.

Wax is bleached by rolling it into thin ribbons, and exposing it to the sun and air. The bleaching is probably due, in part at least, to the ozone of the atmosphere. It can also be bleached by chlorine; but unfortunately the chlorine combines directly with the wax, and is given off when candles made from it are burned. This property of chlorine was first discovered in the last century, by a French chemist who was summoned to investigate the cause of the suffocating odor given off by the candles used for lighting the palace of the Tuileries. The fact that another element could be added to wax without changing its appearance or general properties in any way, was a revelation to the chemists of those days, and marked an epoch in the progress of organic chemistry.

Propolis is a gummy, viscous substance obtained by the bees from the resinous buds and limbs of trees: It is used as a sort of "builder's cement," to fill up cracks in their dwelling, and to mix with the wax to strengthen the attachments of the comb to the sides of the hive. They have been known to entirely cover an intruding snail with a coat of this substance; thus disposing of the animal, and preventing any nuisance arising from its decomposition. Bees have been observed to collect fresh varnish instead of propolis, when it could be obtained; and instances where they have been known to alight on a coffin were probably due rather to the smell of the varnish, than to any regard for the dead. The superstitions regarding bees and funerals may have arisen from some such cause.

Pollen is gathered by the bees in large quantities, and, in connection with honey, is consumed by them as food. As it contains more or less nitrogen, it is admirably adapted to supplement the hydrocarbons of the honey. It is especially indispensable in feeding the

young and immature bees. It has been observed that a bee always confines its visits to one variety of flower at a time, so that pollen of different plants is never mixed. As the cross-fertilization and consequent fertility of plants is largely dependent upon the visits of bees and other insects, this habit is of the greatest importance.

We thus see that, even from a chemical point of view, the contents of a beehive are not without interest; but in comparison with the almost human knowledge displayed by these wonderful insects in bringing up their young, and providing stores of food, it is of but little consequence. Talk about instinct and reason as we may, the dividing line is a very obscure one; and the source of the knowledge which enables the bee to build its comb, and teaches it to lay up a supply of honey for the coming winter, is still an unexplained mystery.

HONEY PRODUCTION IN CALIFORNIA.

SOUTHERN CALIFORNIA is justly celebrated for the quality and variety of its fruits; but comparatively few persons are aware of the extent to which honey is produced there, and the excellence of the product. Believing that pharmacists and other consumers will be interested in knowing where they can procure honey of unsurpassed quality in any desired quantity at a reasonable price, I have been led to prepare this brief account of its production on the Pacific coast.

The honey-producing district includes San Diego, Los Angeles, Ventura, Santa Barbara, and San Bernardino Counties, together with portions of those adjacent. The primary requisites for an apiary are a suitable location, plenty of "bee-feed," and convenient water. The apiaries — or "bee-ranches," as they are commonly called — are mostly located in canyons of the Coast Range Mountains, whose slopes are in many places densely covered with several varieties of wild sage and other honey-bearing shrubs and trees. In addition to these sources of honey-supply, the so-called grasses commonly known as wild alfalfa (*Mekicago sativa*, Linné), and alfilaria, or pin-grass (*Erodium cicutarium*, L'Heritier), are much utilized by the bees in gathering in their supplies. Usually from one hundred to three hundred colonies are kept in one place, the number depending chiefly upon the extent of the range. The hives are made in two compartments; the upper one, called a super, being removable.

The usual size is fourteen by nineteen inches, inside measurement, and ten inches deep; the size of the super being the same. Each compartment is supplied with eight or ten frames placed longitudinally, and supported upon the rabbeted upper edge. A movable horizontal partition separates the two compartments, by which the bees are confined to the lower part of the hive, which is often necessary. The season opens usually about the beginning of March, and continues until the close of July. When fully at work, a large apiary presents a scene of activity not often seen elsewhere; for, in addition to the storing of honey, swarming occurs, frequently to the extent of fifty swarms a day. In a good season it is not uncommon for the number of colonies to be doubled. The method of extracting honey, while familiar to many, may not be without interest. The frames containing the filled combs are taken to the extracting room, where the ends of the cells are sliced off with a long flat-bladed knife. The frames are then placed in the extractor, which consists of an upright tank with a vertical shaft, and from four to eight radial arms, supporting hinged wire cages of sufficient size to admit the frames and support the combs. By means of a simple or geared crank the shaft is rapidly revolved alternately to the right and to the left, and in a few minutes the contents of the comb are thrown out against the sides of the tank, and collect at the bottom, whence the honey is drawn off into storage tanks, to be kept until canned and shipped. The emptied combs are then replaced in the hives to be refilled, which process is repeated a number of times with the same comb, being continued until the comb is destroyed. When it is understood that the amount of bee energy required for a pound of wax will produce twenty pounds of honey, the object of the above-mentioned process will be apparent. "Comb foundation" is largely used in order to save unprofitable energy. It is made by passing thin sheets of wax between metal rollers whose surfaces are so arranged as to produce an exact reproduction of the central partition of a honey-comb. This is fastened into the frame with a little melted wax, and the bees build out the cells just as if they had made the entire comb.

The refuse combs, fragments of combs, scraps, etc., are put into the "sun-extractor," in which, by exposure to the sun's rays, the honey is rendered less viscid, and slowly drains off. This product is, of course, inferior, and is not mixed with the centrifugally extracted honey, being reserved for the bees to forestall a possible honey-famine, which, owing to unfavorable seasons and improvident extraction, sometimes occurs.

It is said that glucose is used not only to feed bees, but also to adulterate honey. I do not know to what extent this practice obtains elsewhere, but a long residence in the honey districts of California, and frequent visits to a large number of apiaries, confirm me in the belief that glucose is not used for either of these purposes there. I have never seen any glucose at an apiary, and the fact that it would be quite as expensive as the honey itself, would preclude its use.

California honey is usually very light-colored, which fact leads many people to believe that it is not pure; but to those who thoroughly understand the circumstances under which it is produced, this seems to be an entirely unfounded prejudice. The amount of honey turned out in a single apiary seems, to those unaccustomed to such things, enormous. Thirty tons of extracted honey have been produced in a single season in an apiary of three hundred colonies. Indeed, three hundred pounds per colony is not uncommon, a super often being filled once in seven days. This large yield depends to some extent upon the assistance given the bees by the apiarist, but chiefly upon the season. If the preceding winter has been dry, or if there is much fog during the period of honey production, the yield will be greatly lessened, and sometimes is barely sufficient to tide the bees over until the next season. Formerly much loss was occasioned in this way; but now a sufficient portion of honey is always held in reserve to keep the colonies in a strong, healthy condition.

The bulk of California honey is shipped in cans, varying in size from twelve to sixty pounds; it can also be obtained in smaller cans and glass jars, if desired. About one-tenth of the entire amount is shipped in the comb. During 1887 there were shipped to the East from Los Angeles 1,256,210 pounds, and from San Francisco 1,090,000 pounds, together with 250,000 pounds of comb honey. Canned honey usually sells at the apiaries at from four to six cents per pound. I have frequently bought honey of superb quality for five cents per pound. In car-load lots it can be laid down in any Eastern city at from two to three cents a pound for freight. It could be sold with profit by retail dealers at ten to twelve cents. Last season was unfavorable for honey production, and in consequence the quality is not up to the standard, although the price is higher than usual. In view of the figures given above as to quantity and price, it would seem that there is no sufficient reason why all persons who use honey for domestic and other purposes cannot be fully supplied. The honey of California is unsurpassed by any in the world, and nowhere else can honey of equal quality be procured in such large amount. There are reliable merchants in each of the counties named who can supply honey of the best flavor and purest quality in any desired quantity, from a single can to a car-load, at prices entirely within the reach of all who are accustomed to the use of pure articles of food.— J. E. S. BELL, *in American Journal of Pharmacy.*

GLEANINGS.

FOR shaded, damp lawns, plant *Poa trivialis*. It will make a velvety carpet under an apple-tree.

THE export of breadstuffs from the United States in 1887 amounted in value to $158,301,708, against $148,123,020 in 1886.

CORN AND WATER. — It has been estimated that during growth Indian corn draws thirty-six times its own weight of water from the soil.

A CONNECTICUT COLT is said to have been found getting pears to eat by rubbing himself against a pear-tree until the shaking brought down the fruit, which he would eat, and then return, and shake the tree again.

VINE-PRUNING. — Professor H. Muller, an eminent botanist, says that the best time to prune vines is while the grapes are ripening, and that the young shoots should be selected for this purpose, as they require for their development a large quantity of sugar, to the detriment of the ripening fruit.

CHERISH THE TOADS. — "I honestly think," says T. D. English, "that a healthy and able-bodied toad, of industrious habits, will get away with and digest his own weight of insects during twenty-four hours. If you be of an inseeticidal turn of mind, turn out by daylight, and watch the toads getting breakfast. It is entertaining."

ELECTRICITY AND WINE. — Recent experiments in Italy give some facts which prove conclusively that a weak but continuous current of electricity through wine causes a deposit of albuminous substances, diminishes slightly the amount of alcohol, which latter is accounted for by increase of acetic acid. It gives to the wine the bouquet which is otherwise only acquired by age, and without doubt aids in the keeping qualities of the wine. There is a hope expressed, that in time there may be a method found by which sterilization will be accomplished by electricity.

WASPS AND BEES. — Bees never injure sound fruit, according to *Popular Gardening*. Wasps will puncture grapes, etc., but with bees it is a physical impossibility. Their mandibles are not so constructed, nor are they strong enough to be used in puncturing fruit. Numerous experiments have been tried; among the rest, one of putting the hives in an apartment, and taking the bees' food away, and making them fast for a few days at a time, and all the time exposing grapes, etc.: but the bees would not do any injury, even under those conditions. If fruit bursts, or is injured by the birds or wasps or something else, the bee will soon suck all the juice; but that is an advantage rather than an injury to the grower, as the sound fruit is apt to rot by coming in contact with such, or by the juice flowing over the sound fruit.

The Popular Science News.

BOSTON, JUNE 1, 1888.

AUSTIN P. NICHOLS, S.B. . . . . *Editor*
WILLIAM J. ROLFE, LITT.D. . . . . *Associate Editor*

When two different metals are placed in a liquid capable of acting chemically upon them, and connected by a wire, as is well known, a current of electricity is produced. It is found also that the difference in chemical action upon two pieces of the same metal is sufficient to produce a very weak current. In the course of some experiments upon this subject, Messrs. Nichols and Franklin (*American Journal of Science*, April, 1888) find, that when two pieces of iron are placed in an acid solution, and one piece is exposed to the influence of a powerful electro-magnet, the current of electricity undergoes very marked variations in strength; in one case, an increase of electromotive force from .6072 to .6361 volts being obtained. This phenomenon, which they call "the electro-motive force of magnetization," they find to be caused by the attraction of the magnet for the salts of iron which are formed by the action of the acid upon the metal. The magnetic attraction causes the dissolved salts of iron to gather around the electrode exposed to its influence, thus causing such modifications of the chemical action as to produce corresponding variations in the electric current produced by it. The paper is one of great interest, and worth reading in full by those interested in physics.

A recent discovery in anatomy is that of the existence of rudimentary valves in the portal veins of newly born infants. These valves are not found in adults, but are common in the lower animals; and, as an additional argument in favor of the Darwinian theory, the discovery is of great scientific importance.

The United States Geological Survey has issued an official report, by Mr. George Goodfellow, of the earthquake in Arizona last May, which contains many points of interest. The region of maximum intensity was in the San Bernardino valley, and the effect of the *temblor* upon the surface of the earth was very marked: great cracks, fissures, and faults were formed, one being over thirty-five miles in length. The destruction in the mountains was very great. "Millions of cubic feet of rock were thrown down from the mountains to the canyons and water-courses below. Cliffs of solid crystalline rock are shattered and split, as if a charge of giant-powder had been lodged carefully amongst them for the express purpose of annihilating them." The alteration in the course and volume of the streams was very marked, and many new springs were formed. The reports of volcanic outbursts were incorrect, but numerous fires were started from falling bowlders and the emission of ignited gases. Heaps of cinders and other evidences of fire were found in several places along the fissures. Taking it altogether, this earthquake must have been one of the most powerful manifestations of natural forces that has ever visited this continent, and it is fortunate that it occurred in a remote and almost uninhabited region.

The Hemenway Exploring Expedition, recently sent out from this city, has been doing most valuable work in studying the relics of the prehistoric inhabitants of Arizona, and have made several discoveries which are of great interest in connection with the above earthquake. It appears that in ancient times they were not uncommon, and, indeed, may have been the cause of the abandonment of the country by its inhabitants. Remains of buildings overthrown by the earthquakes are abundant. A skeleton with broken bones was found just as he was crushed by the falling walls; and on the edge of a fissure a female skeleton was found which was supposed to be that of a maiden sacrificed to appease the wrath of the gods, and prevent a repetition of the calamity. The complete reports of this expedition will doubtless be a valuable contribution to American science.

"Driftwood fires" are a recent novelty in household comfort and decoration. In New Bedford and other seaports, where worn-out vessels are broken up, the wood from which the metallic sheathing has been removed is split up into small pieces, which, when added to a wood fire, will tinge the flames with the most beautiful shades of blue, green, purple, and red. This is due to the salts of copper, zinc, sodium, etc., absorbed by the wood; and an examination of the colored flames with a spectroscope would undoubtedly show the characteristic lines of those metals. Although, strictly speaking, it is not "driftwood" at all, it leaves nothing to be desired either from an æsthetic or ornamental point of view.

The origin of petroleum has been explained both on the organic and inorganic theory. The commonly accepted view, which is held by many American geologists, is, that it has been formed by the distillation of organic remains by the internal heat of the earth. Others consider that it has been formed directly from its elements by chemical reactions, and that its existence is in no way dependent upon the organic remains of former geological ages. Professor Mendelejeff, the distinguished Russian chemist, has recently advanced a theory of the inorganic origin of petroleum which is of considerable interest. Briefly stated, he believes that in the interior of the earth iron is present in large quantities, combined with carbon in the form of a carbide. Now, when water from the surface reaches this heated carbide of iron, the oxygen combines with the iron, replacing the carbon, which unites with the hydrogen, forming the hydrocarbons of which petroleum and natural gas are principally composed. The most important practical point of this theory is, that, if true, the formation of these substances may be continually going on, so that we need have no fear of the supply becoming exhausted. Of course, this theory has yet to be confirmed; but it is to be hoped that it may prove true, in so far, at least, as regards a continuous formation of these invaluable natural products.

SCIENCE IN THE BACON-SHAKESPEARE CONTROVERSY.

The advocates of the Baconian theory of the authorship of Shakespeare's works are wont to complain that their opponents select only their weakest arguments for refutation or ridicule, ignoring the more weighty reasons urged in support of their wild notions; but to us it seems difficult to find any argument on that side which is much better or worse than any other. As Rosalind says of the evils that her uncle laid to the charge of women, they are "all like one another as halfpence are." It is not easy, indeed, to burlesque the Baconian foolery, for much that its advocates themselves have urged is more absurd than any thing one can imagine as a caricature of it.

Here is a little pamphlet (twenty-eight pages) published by Mrs. Henry Pott, the accomplished editor of Bacon's *Promus*, giving "32 Reasons" for believing that Bacon wrote "Shakespeare." It purports to be a concise statement of the best that can be said in behalf of this belief. If we take from this source our illustrations of the scientific "parallelisms" assumed to exist in the works of Shakespeare and Bacon, and tending to show that the authors are one and the same, we surely shall not be obnoxious to the charge of unfairness referred to above.

Mrs. Pott's 14th "reason" for the faith that is in her is as follows: —

> That, with regard to the internal evidence of the plays, it has been found that the knowledge which is displayed in them concerns subjects which Bacon particularly studied. . . . That the plays may therefore be elucidated by a study of Bacon's scientific works.

Then follow "Examples," grouped under the headings of "Law" (with which Shakespeare unquestionably had a good general acquaintance, perhaps mainly due to his spending some time in an attorney's office in his youth, as tradition tells), "Horticulture," "Medicine," and "General Science." Under "Horticulture" we are told that "of the thirty-three flowers of Shakespeare, Bacon enumerates thirty in his *Essay of Gardens* or in his scanty notes on 'Flowers' in the *Sylva Sylvarum*." There is nothing remarkable in this. Shakespeare was fond of flowers, and at one time and another refers to most of those which were then favorites in garden or field. Bacon, writing a formal essay on practical gardening, would, of course, mention most of these flowers. Mrs. Pott thinks there is a significant resemblance in the passages concerning particular flowers, but let the reader judge whether this is so. Her first quotation from Bacon is: "The flowers that come early are the primrose, violets, and daffodillies." If any writer is describing the succession of flowers, or has occasion to allude to those of early spring, he may be expected to mention

one or more of these, which are so familiarly associated with "the opening year." We need not therefore suspect that the sage of St. Albans is masquerading under the guise of the Stratford dramatist when we find the latter writing in the *Winter's Tale* (iv. 3) : —

"When daffodils begin to peer,
Then comes in the sweet o' the year."

But Bacon specifies the very *month* in which violets, and *blue* violets (think of that!), as well as daffodils and daisies, appear; for he says : "In *March* there come violets, especially the single *blue*, which are earliest, the yellow *daffodil*, the *daisy*," etc. Can it be other than the same man who in *Love's Labour's Lost* (v. 2) alludes to "*daisies* pied and *violets blue*," and in the *Winter's Tale* (iv. 3) to

"*Daffodils* that come before the swallow dares,
And take the winds of *March* with beauty"?

And must we not exclaim with Leonato in *Much Ado* (iv. 1) : —

"Confirm'd, confirm'd! O, that is stronger made,
Which was before barr'd up with ribs of iron!"

when we actually find both Bacon and Shakespeare referring to *lilies* in *April* and *roses* in *May*? Moreover, Bacon goes so far as to connect roses with "a morning's dew;" and in the *Taming of the Shrew* (ii. 1) is there not writ, "Clear as morning roses *newly washed in dew*"? And yet there be obstinate folk who will persist in saying that here we have two writers instead of one! And they both call *violets* "sweet," and *honeysuckles* also; and both speak of "*velvet* leaves;" and both of flowers opening and closing when the sun shines or is overcast. We have quoted nearly all the examples given by Mrs. Pott under this head. She adds: "N.B. — Simple as these observations seem, they were new in the days of Bacon." We will not waste space in disproving this amazing assertion.

Under "Medicine" no examples are given. We have only the general statement that "there is scarcely any thing pointed out by Dr. Bucknill in his *Medical Knowledge of Shakespeare* which is not seen to have been the subject of Bacon's notes and lucubrations."

Under "General Science" we read : —

Not only Bacon's theories, but his scientific errors, are in the plays. In his early works he spoke of heat as a kind of matter, of which one mass could displace another, and of which two masses could not mix (*Nat. Hist.*, i. 31; *Novum Organon*, xiii. 34). So in the plays, "One heat another heat expels" (*T. G. of V.*, ii. 4), "One fire burns out another's burning" (*K. John*, i. 2), "As fire drives out fire" (*J. Cæsar*, iii. 1, etc.).

It is sufficient to say that the passages from Shakespeare are in no sense "scientific," but simply allusions to the old-fashioned homœopathic treatment of a burn by holding it near the fire, as unlettered folk had done long before Bacon's nonsense about "heat as a kind of matter" had been put in print.

In the *Natural History* (iii. 29) we read: "For *cold* we must stay till it cometh." In *King John* (v. 7) the fevered monarch says : —

"And none of you will bid the winter come,
To thrust his icy fingers in my maw," etc.

This is an apt example of Mrs. Pott's introductory remark, that "the plays may be elucidated by a study of Bacon's scientific works." Bacon the poet makes the king complain because his servants do not "bid the winter come" in the middle of October; Bacon the philosopher makes it clear how unreasonable John was. He *couldn't* have the icy weather at that time of year: science declares that "for cold we must *stay till it cometh*." "How charming is divine philosophy," as Milton exclaims, especially when it "elucidates" the obscurities of poetry! How much easier reading Browning's poems might have been if Bacon had only lived to write them! The "parallelisms" in his philosophical works would have poured a flood of light into their most abysmal obscurities.

There are some astounding coincidences in *acoustical* science in the two Bacons. He of St. Albans remarks: "One of the strangest secrets is, that the whole sound is in every part of the air;" and he of Stratford several times refers to music "in the air" (*Tempest*, i. 2, iii. 2; and *Ant. and Cleo.*, iv. 3). The following (which we give verbatim, italics and all, as Mrs. Pott puts it) is perhaps even more extraordinary : —

For Bacon's study "of articulate sounds of the voice of man *through chinks and crannies* . . . and *if you speak at the farther side of a close wall*" (*N. H.*, 314, 321; see *M. N. D.*, iii. 1, 65, vi. 130–211, *apropos* to Pyramus and Thisbe).

If this were printed as a burlesque of the Baconians, who would doubt its being a burlesque? The clowns' interlude in the *Midsummer-Night's Dream* is a burlesque; but when Bacon wrote it he could not entirely sink the scientist in the dramatist, and the amorous confidences of Pyramus and Thisbe through Wall's parted fingers must find their perfect "elucidation" in the "study of articulate sounds" in the *Natural History*.

We can give but one more pair of quotations under this head; and we solemnly assure the reader that this also (italics and all) is from Mrs. Pott, not a malicious joke of our own : —

"Aristotle dogmatically assigned the cause of generation to the sun" (*Nov. Org.*, ii.)

Hamlet (to Polonius). "Have you a daughter? . . . *Let her not walk in the sun.* Conception is a blessing, but not as your daughter may conceive."

Mrs. Pott's 20th "reason" reads thus : —

That where there are several editions of the same play, Bacon's increased knowledge and new interests will be seen reflected in the latter edition, though they are absent from the earliest edition.

The first scientific illustration under this heading is as follows : —

The study of "The Winds" does not appear in the earlier editions of *Hamlet;* the poet had not made up his mind to make use of them until he prepared the edition of 1605.

Hence the expression, "as the winds give benefit," is not used by Laertes in i. 3 in the 1603 edition, but appears first in 1605. So in the former edition Hamlet (v. 2) says, "By my troth, methinks 'tis very cold;" but in the latter he says, "No, believe me, 'tis very cold; *the wind is northerly.*" Whether nowadays a man's remarking that "the wind is northerly" would indicate that he had been making a special study of the winds, or writing a scientific treatise thereupon, we cannot say; but that we should have missed this anemological addition to Hamlet's comment on the weather if Bacon, between 1603 and 1605, had not turned his mighty mind to ventose investigation, is clear as proofs of holy writ — unless Mrs. Pott is mistaken.

The above are fair specimens of these carefully selected "parallelisms" of a scientific character which Mrs. Pott finds in the works of Bacon and Shakespeare. They are of a piece with those cited in illustration of the rest of her "32 Reasons." And Mrs. Pott is the ablest advocate of the Baconian theory in England (and, aside from this monomania, a very bright woman), as Judge Holmes is in this country.

[Special correspondence of the *Popular Science News.*]

PARIS LETTER.

Two newly appointed professors have recently delivered their inaugural address. The one, Professor Ch. Richet, appointed professor of physiology to the Paris Medical School, is already well known to students as a lecturer and as the author of many good works and interesting experiments. The other is M. Th. Ribot, appointed professor of experimental psychology in the College of France by the energy of M. G. Renan. Professor Ribot's appointment was opposed by the old school of psychology, and energetically advocated by the young one, the disciples of Spencer's, Bain's, and Wundt's schools of the modern psychology. M. Ribot is a very able writer and psychologist, who has done a great deal for the dissemination of knowledge concerning the modern English and German psychology in France, and thus rendered good service.

M. J. DE GUERNE is about to publish a very interesting work concerning the results of his investigations with the Prince of Monaco in zoology and marine biology. In this work a very good chapter concerns the manner in which the author supposes the Azores to have been peopled. The general character of the Azorean fauna is quite European. Among Coleoptera, eighty-two per cent are European, the remainder being American or belonging to other parts of the Atlantic. A single species of birds is special to the Azores, but among mollusks over a half of the species is peculiar to these islands. The sweet-water fauna is entirely European, save three or four species. M. de Guerne notices that the geographical distribution of aquatic species (of fresh water) is much wider in the Azores than in many parts of the Continent. This he explains on the ground that the Azorean species are nearly or all of types that are easily disseminated. To the wind itself M. de Guerne ascribes but a feeble part in the process, and believes that most has been done by birds. He shows that many eggs of invertebrated animals are easily taken up by the feathers of aquatic birds, and that these eggs will easily withstand a long drought, and develop when favorable circumstances recur; that is, when the bird again alights in a stream or lake. Birds also help in dispersing animals, mollusks especially, which cling in some way or other to their legs, or are embedded in the mud which is frequently found on their feet or feathers, as Darwin has seen. M. de Guerne does not feel inclined to consider the fauna of the Azores as bearing any Alpine character,

and does not believe that this fauna is the remnant of that of a continent formerly in communication with Europe. His work will certainly prove a very interesting one.

M. Wasserzug, one of Pasteur's assistants, who died some days ago, much to the regret of those interested in bacteriology, has recently published a good paper, in the *Annales de l'Institut Pasteur*, on the variations, morphological and functional, of different species of bacteria. He has seen that certain functions may be experimentally abolished, such as the chromatic function, and fully believes that permanent variations might be induced, and, in fact, different species created, with the aid of time, if bacteria were to be submitted to the influence of peculiar media. It is a very probable fact, indeed, and an interesting one. The experiment is worth trying; and it is a pity M. Wasserzug, quite a young man, should have died while engaged in these interesting pursuits.

A new professorship is to be soon created in the venerable Sorbonne, in the Faculty of Sciences, that will cause many to shriek in despair. It is the professorship of philosophical biology, which is to be offered to Professor Giard, and devoted to the study of zoölogical doctrines, and more especially of Darwinism. To many zoölogists of the old school, Darwinism is a frightful nightmare, and their execration is in advance promised to all who follow Darwin. But they are not eternal; and it is certain, that, notwithstanding the efforts made by many of these older zoölogists to keep Darwinism in the dark, all the young men are Darwinians. Professor Giard is quite a Darwinian *stricto sensu*, but does not admit the vagaries of the ultra Darwinians. His intention is to study Darwinism especially in the light of embryology. The new professorship will be created on the propositiou of the Paris Municipal Board, which has voted the necessary funds. Professor Giard will also have one or two assistants and a laboratory. It is but time that France, the mother of Lamarck and Geoffroy Saint-Hilaire, should have a professorship of Darwinism, as is the case in England, Germany, etc.; and it is high time, also, that the general public should be no longer deluded concerning Darwinism by the ignorance or ill will of the official pedagogues. So many and complete stupidities have been said by some of them on the matter, that it is necessary that some answer should come and put things straight, — a very difficult thing sometimes, when one considers how easily errors and falsehoods become accredited. These are innumerable concerning Darwinism. It has been discussed by any amount of persons who had not the slightest idea of the real aim and purport of Darwin's views, and had never read his works; it is time it should be explained by persons who have read and learnt, and are able to give a candid and competent opinion.

Some interesting books have been published of late. Among them I will only notice the principal. There is Professor Émile Blanchard's *La Vie des Êtres animés*. Professor Blanchard is now an old man, whose life, entirely and untiringly devoted to science, has been a long study of animal life and forms, and more especially of insects, whose anatomy and habits he has well studied; so well, indeed, that his eyes are almost lost, owing to a continuous use of the microscope. He has, nevertheless, courage and will enough to continue his work, and the book we are speaking of is his last contribution to science. Professor Blanchard has at all times been a decided adversary of the evolution theory and of the Darwinian views on the origin of species, and in his recent book he comes out as strong as he can against them. His work is an interesting one, surely, but it is not enough abreast with the positive facts of science to prove very convincing to competent naturalists. He wholly ignores the embryological arguments in favor of Darwinism, and takes no notice of paleontological evidence, and sums up his objections in requiring evidence of the transformation of any given species into another one, well recognized as such. Such evidence is not yet very abundant, certainly; but there are facts which are of great interest as bearing on the point in discussion. Schmankevitsch showed, some years ago, that a crustacean, *Artemia salina*, can be easily transformed into the species known as *Artemia Milhausenii*, and reciprocally, merely by subtracting or adding salt to the water in which these species live. It is merely the constancy of the external conditions of life, as Professor Semper says, the greater or less saltness of the water, which in one case determines the character of *Artemia Milhausenii*, and in another that of *A. salina*. But Schmankevitsch has been able to push the experiment farther on, and, by adding fresh water, has been able to transform *A. salina* into a new genus, — the genus *Branchipus*. Such facts are of utmost importance, and we regret that Professor Blanchard has overlooked or ignored them in his book. His work is very pleasantly written, and is the fruit of a long personal experience, but does not take notice enough, it seems to us, of the experience of others. Among the other books, one will notice the second volume of the *Études experimentales et cliniques sur la Tuberculose*. This periodical is continuing its usual work, and contains many interesting papers on the different methods of treating tuberculosis, or on the experiments which may conduce to a rational treatment thereof, especially to an anti-tubercular vaccination. Some of the contributions are of little value, their authors having no personal experience in chemical and physiological researches, and confining themselves strictly to clinical work; but, upon the whole, the *Études* are very valuable indeed. Concerning tuberculosis, we will also note the appearance of Cornile Hérard and Hanat's *La Phthisie pulmonaire*. It is a good book, embodying all that is at present known concerning the question. Messrs. Beauregard and Galippe's *Guide pratique pour les travaux de Micrographie* is a second edition of a good book; and M. Piderit's *La Mimique et la Physiognomonie* (translated from the German) will prove useful to artists, psychologists, and physiologists likewise. H.

Paris, *April* 21, 1888.

THE OLDEST ROCKS.

Oldest of all the formations known to geologists, and representing perhaps the earliest rocks produced after our earth had ceased to be a molten mass, are the hard, crystalline, and much contorted rocks named by the late Sir W. E. Logan, Laurentian, and which are largely developed in the northern parts of North America and Europe, and in many other regions. So numerous and extensive, indeed, are the exposures of these rocks, that we have good reason to believe that they underlie all the other formations of our contineuts, and are even world-wide in their distribution. In the lower part of this great system of rocks, which, in some places at least, is thirty thousand feet in thickness, we find no traces of the existence of any living thing on the earth. But, in the middle portion of the Laurentian, rocks are found which indicate that there was already land and water, and that the waters, and possibly the land, were already tenanted by living beings. The great beds of limestone which exist in this part of the system furnish one indication of this. In the later geological formations the limestones are mostly organic; that is, they consist of accumulated remains of shells, corals, and other hard parts of marine animals, which are composed of calcium carbonate, which the animals obtain directly from their food, and indirectly from the calcareous matter dissolved in the sea-water. In like manner, great beds of iron ore exist in the Laurentian; but in later formations the determining cause of the accumulation of such beds is the partial deoxidation and solution of the peroxide of iron by the agency of organic matter. Besides this, certain forms known as *Eozoon Canadense* have been recognized in the Laurentian limestones, which indicate the presence at least of one of the lower types of marine animals. Where animal life is, we may fairly infer the existence of vegetable life as well, since the plant is the only producer of food for the animal. — Sir William Dawson, *in Popular Science Monthly*.

[Specially reported for the *Popular Science News* from the Observatory of the College of New Jersey.]

ASTRONOMICAL PHENOMENA FOR JUNE, 1888.

The Planets. — Mercury is an evening star, coming to greatest elongation on June 12, when it will be 24° east of the Sun. It will probably be visible in the western sky, near the horizon, soon after sunset on any clear evening during the first half of the month. Venus is still a morning star, but is very close to the Sun, and is not in good position to be seen. It will be in superior conjunction with the Sun on July 11. Mars is still in pretty good position for observation, but is rapidly increasing its distance from the Earth; its distance at the end of the month being one and one-half times what it was at opposition in April. It is in the constellation Virgo, is moving eastward, and at the end of the month is nearly due north of Spica (*Alpha* Virginis). It is on the meridian at 8 P.M. on June 1, and at 6*h*. 30*m*. P.M. on June 30. Jupiter rises earlier than during May, and is gettiug into good position for observation in the evening, rising before sunset. It is on the meridian at a little after 11 P.M. on June 1, and at about 9 P.M on June 30. It is about 1° 30′ west of the second-magnitude star *Beta* Scorpii on June 1, and moves westward 3° during the month. The following eclipses of Jupiter's satellites are visible in the United States during the month. The phenomena all take place near the planet on the upper right-hand quadrant, as seen in an inverting telescope, and are all reappearances, except one for the third satellite, where both disappearance and reappearance can be seen. D denotes disappearance, and R reappearance. Times are Eastern standard.

I. R. June 1, 8h. 18m. P.M.	II. R. June 21, 2h. 1m. A.M.
II. R. June 6, 8h. 48m. P.M.	I. R. June 23, 2h. 1m. A.M.
I. R. June 7, 3h. 43m. A.M.	I. R. June 24, 8h. 29m. P.M.
I. R. June 8, 10h. 12m. P.M.	III. D. June 25, 10h. 14m. P.M.
II. R. June 13, 11h. 25m. P.M.	III. R. June 25, 11h. 59m. P.M.
I. R. June 14, 5h. 38m. A.M.	II. R. June 28, 4h. 38m. A.M.
I. R. June 16, 12h. 6m. A.M.	I. R. June 30. 3h. 55m. A.M.

Saturn is still to be seen in the western sky in the evening; but the Sun is rapidly approaching it, and by the end of the month the planet sets a little less thau two hours after the Sun. Uranus is in the constellation Virgo. On June 6 Mars passes 47′ to the north. Early in July Uranus is in quadrature with the Sun. Neptune is a morning star, very close to the Sun.

The Constellations. — The positions given hold good for latitudes differing not many degrees from 40° north, and for 10 P.M. on June 1, 9 P.M. on June 15, and 8 P.M on June 30. Boötes is in the zenith; Libra is on the southern meridian, about

halfway up, and Scorpius, with Jupiter, is a little below and to the east of Libra; Sagittarius is on the south-east horizon; Corona Borealis is near the zenith, to the south-east; Hercules is high up in the east, and Aquila is below it; Lyra is about halfway from horizon to zenith, a little north of east; and Cygnus is below Lyra, in the north-east. The bright stars in the head of Draco are in the north-east, high up. Ursa Minor is on the meridian, mainly between the pole and the zenith; Cepheus is a little below and to the right of the pole star, and Cassiopeia is near the horizon, a little east of north; Auriga is just setting about 20° west of the north point; Ursa Major is in the north-west, high up; Gemini is setting a little north of west; Cancer, with Saturn, is a little above, to the left; Leo is above Cancer, and nearly due west; Virgo, with Mars and Uranus, is in the south-west, about halfway up.

PRINCETON, *May* 5, 1888.

[Specially reported for the *Popular Science News*.]

METEOROLOGY FOR APRIL, 1888.

TEMPERATURE.

AVERAGE THERMOMETER.	Lowest.	Highest.	Range.
At 7 A.M.	38.40°	22°	60°	38°
At 2 P.M.	49.97°	34°	77°	43°
At 9 P.M.	40.40°	29°	57°	28°
Whole month	42.92°	22°	77°	55°
Last eighteen Aprils	44.72°	38.17°, in 1874.	50.61°, in 1878.	12.44°

The 8th was the coldest, and the 28th the warmest, day of the month, averaging 28½° and 62° respectively. The 29th was only one-third of a degree below the 28th. The lowest point reached was 22°, on the 8th; the highest 77°, on the 28th. The entire month was 1.80° below the average of April in eighteen years. The second average was 42.29°. The temperature was very uniform on the 2d, varying only from 36° to 39°. The most sudden change was 21° in seventeen hours, following 2 P.M. on the 7th.

SKY.

The face of the sky in 90 observations gave 55 fair, 7 cloudy, 20 overcast, 6 rainy, and 2 snowy, — a percentage of .611 fair. The average fair observations the last eighteen Aprils has been 514, with extremes of .322, in 1878, and .700, in 1872. Thunder and lightning occurred about 3 A.M. on the 6th.

PRECIPITATION.

The amount of precipitation the past month, including snow, was 3.02 inches, while the average for the last twenty Aprils has been 3.94, with extremes of 1.20, in 1869, and 8.50, in 1870. There were traces of snow on the 2d and 21st, with half an inch on the 10th. From this last date to the end of the month the precipitation was only .32 inch. As illustrative of the beautiful variety in nature, may be mentioned the slight trace of snow on the afternoon of the 21st, which fell, not as feathery flakes, but in tiny, solid spheres, as if fairies were indulging in a merry game of snowball.

PRESSURE.

The average pressure was 30.054 inches, with extremes of 29.65, on the 2d, and 30.47, on the 26th, — a range of .82 inch. The average for the last fifteen Aprils has been 29.891, with extremes of 29.767, in 1884, and 30.078, in 1886. The sum of the daily variations was 5 32 inches, giving an average daily movement of .177 inch, which is the average for the last fifteen Aprils, with extremes of .139 and .239. The largest daily movements were .48 inch, on the 3d, .40, on the 2d, and .38, on the 6th, all in connection with rainfall. The barometric pressure was remarkably high for April, exceeded but once in fifteen years; and the changes slight but frequent. A high pressure seems to *check* precipitation.

WINDS.

The direction of the wind in 90 observations gave 15 N., 3 S., 6 E., 16 W., 3 N.E., 33 N.W., 5 S.E., and 9 S.W., an excess of 34 northerly and 44 westerly over the southerly and easterly, indicating the approximate average direction to be W. 37° 42′ N. The westerly winds in April for nineteen years have uniformly prevailed over the easterly, with two exceptions (1870 and 1877), by an average of 25.42 observations, and the northerly over the southerly, with a single exception (1880), by an average of 21.37; showing the general average of April in nineteen years to be W. 40° 3′ N. The relative progressive distance travelled by the wind the past month was 55.61 units, and during the last nineteen Aprils 631 such units, — an average of 33.21; showing far less opposing winds than usual.

IN REVIEW.

The present April has been unusually cold and fair, with high pressure, and winds largely northwesterly. Their unit distance travelled was also unusually large, and the rainfall small, for April.

D. W.

NATICK, *May* 7, 1888.

QUESTIONS AND ANSWERS.

LETTERS of inquiry should enclose a two-cent stamp, as well as the name and address of the writer, which will not be published.

QUESTIONS regarding the treatment of diseases cannot be answered in this column.

C. W. — (1) Storage batteries do not really store electricity, but are simply batteries which, after having once produced a current of electricity by chemicals in the ordinary way, can be renewed by passing another current through them in a reverse direction. They can then produce another direct current as before. (2) Celluloid is principally composed of gun-cotton and camphor. We know of no reason why celluloid collars or cuffs should produce eruptions on the skin, or be injurious in any way. (3) Galvanized iron vessels should not be used in the dairy, as the zinc is readily attacked by the acid of sour milk (lactic acid), forming unwholesome salts.

E. W. A., *Texas*. — A "dialytic" telescope is one containing an additional lens, about halfway between the object-glass and eyepiece, for the purpose of correcting those errors of refraction which produce chromatic aberration, or colored fringes around the objects viewed. This arrangement is now very rarely met with, as the usual plan is to make the object-glass itself of two pieces of glass of different densities, by which the aberration is entirely prevented.

A. T, *New York*. — How are the test-papers prepared for detecting the presence of ozone in the atmosphere?

Answer. — A thin paste is made with boiling water and starch, a few drops of solution of iodide of potassium added, and the mixture well stirred with a glass rod. This is brushed over strips of white filter or blotting paper, which are exposed to the air while damp. If ozone is present, the iodide of potassium is decomposed, and the iodine unites with the starch, forming a blue compound. These papers must be freshly made each time they are used, and not allowed to dry.

O. W. D., *Massachusetts*. — Does mica transmit the rays of light and heat with equal freedom?

Answer. — It depends upon the color of the mica. The white, transparent varieties transmit a larger proportion of light rays, while the dark-colored micas may be nearly opaque to light, and yet transmit nearly as much heat as the transparent mineral. We do not find the relative diathermancy of mica given by any authority to which we can refer.

J. A. M., *Texas*. — Is the length of the day and night equal at all points on the equator, or only where it is intersected by the ecliptic?

Answer. — Without taking into account the small variations due to refraction, etc., the days and nights are always of equal length at all points on the equator, without regard to the position of the ecliptic.

E. B. S., *Virginia*. — What is meant by gold being so many "carats fine"?

Answer. — A "carat" is a weight used by jewellers, and is equal to twelve grains. The weight is used arbitrarily to denote the proportion of pure gold in an alloy. Twenty-four carats fine is pure gold; eighteen carats fine, eighteen parts of gold, and six of copper or silver. Nearly all gold coins and jewelry are alloyed with copper or silver, to make the metal harder and more durable.

S. L., *Belmont*. — What is the cause of the phosphorescent light produced by glow-worms and similar insects?

Answer. — Recent investigations seem to show that it is caused by a substance called *noctilucine*, which is secreted by the animal, and that the light is due to the slow oxidation of that substance. If some of these insects have been seen to retain their luminosity in a vacuum or in hydrogen gas, it is because their tissue always contains enough oxygen to allow the slow oxidation of the noctilucine to continue under the circumstances for a certain length of time.

LITERARY NOTES.

Volcanoes and Earthquakes. By Samuel Kneeland, A.M., M.D. Boston: D. Lothrop & Co. $2.50.

This handsome volume gives "a popular account of the nature, causes, effects, and geographical distribution of volcanoes and earthquakes, from personal observation in the Hawaiian and Philippine Islands, Japan, Iceland, the Mediterranean Basin, Spain, and the United States." The fact that the material is the result of the author's own observation adds to the interest of the book, no less than to its accuracy. It reads like a history of personal adventure, rather than like a dry, scientific treatise, and thus becomes "popular" in the best sense, while it is thoroughly scientific. The illustrations are coarse; but, being from photographs and drawings made on the spot, they are true to nature, and serve to make many points clear which words could not adequately describe.

The Satchel Guide to Europe. 3d edition for 1888. Boston: Houghton, Mifflin, & Co. $1.50.

This useful companion for the vacation tourist increases in popularity every year. Five editions were issued in 1887, and the third for 1888 has already been called for. The success of the book is due to its honesty and accuracy, and to the fact that it hits the golden mean between the extreme conciseness of guide-books which, in attempting to put all Europe into a "pocket" form, give merely a dry, index-like list of objects of interest, and the bulky diffuseness of volumes which, though good reading at home before or after a tour, are clumsy and inconvenient while travelling, especially if one takes the minimum of luggage.

Principles and Practice of Morality. By Ezekiel Gilman Robinson, D.D., LL.D., President of Brown University. Introductory price, $1.50. Silver, Rogers, & Co., publishers, 50 Bromfield Street, Boston.

The whole subject of morals has been exhaustively rediscussed in recent years, from both the scientific and the philosophical points of view. The results of the rediscussion are seen in a marked modification of ethical theories. The basis of utilitarianism has been reconstructed, and corresponding changes have taken place in the methods of intuitionism.

As a text-book on this important subject, President Robinson's *Principles and Practice of Morality* cannot fail to attract wide attention, and to command the interest of all teachers, students, and general readers of ethical science. It is a timely book, such as might be expected from its eminent and learned author, and we predict for it extensive use in the colleges of the country.

The Writers' Publishing Company of New York have issued a handbook of the Agassiz Association, under the title *Three Kingdoms*. It is especially devoted to the purposes of this most useful society, and gives a great deal of valuable information regarding the collection and preservation of natural objects and curiosities, whether animal, vegetable, or mineral.

The Three Ethical Codes. By the Illustrated Medical Journal Company, publishers, Detroit, Mich. Cloth, 55 pages. Postpaid, 50 cents.

It is a handy little book for reference as occasions may require.

Medicine and Pharmacy.

THE MIND-CURE.

The mind-cure craze, with its various modifications of faith-cure, mental healing, Christian science, and other foolishness, appears to have originated in this city, whence it has spread in all directions, until there is hardly a city or town of any size in the country but has one or more disciples of this latest development of the art of healing all manner of diseases without the aid of physician or medicine.

We must confess that we have not a very clear comprehension of the intricate doctrines of this new school, and, in fact, have never heard or read any thing on the subject from its disciples which has lifted in the slightest degree the cloud of ignorance in which we are enveloped. Neither do we see in what the "faith-healer" differs from a "Christian scientist," or a "metaphysician" from the only original "mind-healer." The explanations given by the adepts in these mystic arts have an amusing resemblance to the theory of the famous Keeley motor as elucidated by its inventor,—"sound and fury, signifying nothing." We understand, however, that the general idea as agreed upon by the different sects is, that there is a certain power in the human mind which influences the material body, and may do so to such an extent, particularly when strengthened by faith in the power of the Supreme Being, that disease may be cured without the aid of material medicine or medical care of any sort.

The good effect of the companionship of a cheerful and strong-minded person upon one of a feeble and depressed spirit is undeniable. Often, from long-continued illness, the patient is brought into such a condition that he takes his illness as a matter of course, loses all confidence in himself, and makes no effort whatever towards recovery, even when the natural course of the disease is entirely terminated. In such a case, the performances of a bright, cheerful, vigorous mind-healer, who assures the patient that there is nothing the matter with him, and he has only to say that he is well and he will be well, would doubtless have a surprising effect; but in such a case there is no more a cure of disease than there is in urging forward a tired or lazy horse. We do not believe that there is any power whatever in the human mind to change the natural course of any organic or functional disease in the slightest degree.

We all know that pain exists, and have known what it is. A person suffering from the toothache is not easily convinced that there is "no such thing as pain." He is unpleasantly aware that there is such a thing as the toothache, and that the only effective 'mind-cure" is to make up his mind to interview the dentist. And if the power of the will cannot even stop the vibrations of an exposed dental nerve, how much less effect must it have upon the progress of any serious disease, where the most important functions of the system may be impaired, the tissues themselves structurally changed, or the bones broken! for some persons even go so far as to say that broken bones may be made to mend themselves by this wonderful power, and soberly give instances occurring in their own experience. There is but one answer to make to these persons who tax our credulity with such stories, and that is the answer to a certain classical conundrum involving an impossibility,—the boy lied.

A very strong point in favor of the mind-cure is the fact that the tendency of the majority of diseases is towards recovery. Regular physicians are every day trusting more and more to the *vis medicatrix naturæ*, and less to the power of drugs and chemicals. Simple remedies and good nursing are half the battle; and if a patient afflicted with the mumps, measles, sore throat, or even some of the more serious diseases, is treated by any of the different classes of mental healers, he will probably recover, and another victory is scored for "Christian science." The fact that he would have got well anyway, even if he had been "conjured" by a negro voudou or anointed with oil by a Mormon elder, is not taken into account.

An enthusiastic healer once related to us the remarkable success he had had in the treatment of a small boy who had developed an exceedingly vigorous boil. "The treatment was perfectly successful," he declared. "Did the boil break?" we inquired. "Oh, yes, after a week's treatment it broke, and the child was soon perfectly well." We said nothing more, but recalled to mind several instances in our own personal experience where these "Job's comforters" had broken without the slightest exercise of faith, will-power, or even Christian science on our part.

The acceptance of such absurd theories among so many persons of superior intelligence and intellectual ability is hard to account for, and we can only explain it by the lack of scientific training in the schools. So much time is taken up with the dead languages, or wasted in innumerable studies of little or no importance, that no time is left for the attainment of the power to make observations correctly, and reason upon them in an intelligent and scientific manner; and until a radical change is made in this respect, we fear that mind-cures, patent medicines, Keeley motors, perpetual motions, and the thousand and one humbugs of every-day life, will continue to flourish, and gather in their dupes as heretofore.

[Specially compiled for the *Popular Science News.*]

MONTHLY SUMMARY OF MEDICAL PROGRESS.

BY W. S. WELLS, M.D.

Dr. Paulinis publishes, in the *Bulletin Médical*, a report of an epidemic of diphtheria occurring in one of the Grecian isles, which lends considerable support to the possibility that this disease may originate from poultry.

For over thirty years no case of diphtheria had been seen on the island. Suddenly the disease developed, and five fatal cases occurred in one family. The epidemic soon spread through the entire community, thirty-six dying from the disease. Upon examination to discover its source, it was found that a flock of turkeys had been received, some three weeks before, from Salonica. Two of the turkeys were sick on their arrival, and each of the others was attacked in succession. Dr. Paulinis found two of them still sick, and inspection showed patches of pseudo-membrane on the mucous membrane of the vault of the palate and of the pharynx.

On detaching strips of the exudation by the forceps, the mucous membrane beneath was seen to bleed slightly. The glands of the neck were swollen, and in one of the fowls the diphtheritic process had extended to the larynx, as was shown by the hoarseness of the cry and the difficult breathing. One of the turkeys, which had recovered from the throat affection, suffered from paralysis of the legs, being unable to walk.

The garden where the turkeys were was at the northern extremity of the town, and the first children attacked were in the immediate neighborhood; and there was a north wind blowing the greater part of the time, which the doctor believes disseminated the germs of the disease. He concluded, from his experience, that the diphtheria of the fowl is similar in its course and symptoms to the disease occurring in man, and that it can be carried from the one to the other, sometimes through the medium of the air. This suggestion that the human disease might originate from, or be spread through the agency of, chickens or other poultry, has been noted by other writers, as well as that cats or other pets may convey the poison from one family to another.

At the St. Louis Medico-Chirurgical Society Dr. Todd stated that in the dissecting-room had been found a subject without clavicles (collar-bones). There was nothing but a fibrous cord to represent them. In the literature of the subject which he had searched Dr. Todd had been unable to find any cases of this kind reported, although the radius, fibula, and some other bones have in rare cases been found absent. In the remarks following, Dr. Barclay observed that it was an interesting fact in comparative anatomy that in some species of the cat tribe the clavicles are simply rudimentary. Dr. Fry stated that several varieties of highly organized vertebrata have no clavicles; the bears, for instance.

Dr. Todd continued by stating that very few animals have clavicles. It is only those animals that use the anterior extremities as man does, that have clavicles at all. The herbivora and carnivora, even the lion, has none. The claviele of the African lion is only an inch and a half or two inches long, and is embedded in a mass of muscles of the neck. Of course, in these animals the shoulders do not have to be kept apart.

In birds, where the pectoral muscles (breast)

are very strong, the clavicles are enormous. In birds which have great power of flight the clavicles are anchylosed or solidly attached. The doctor regarded it as very curious to meet with a case of an adult person without clavicles. It is one of the first bones to ossify in a human skeleton.

DR. ORECCHIA (*Gazzetta degli Ospitali*) has recently called attention to the frequent combination of inflammation with cancer in the same part, the cancer being sometimes so obscured in this way as to be overlooked for a considerable time. He reports cases in which this occurred. In one of these there was cancer of the larynx, which was supposed to be nothing more than simple inflammation of the membrane investing the organ of the voice; in two cases of supposed inflammation, simple, of the jaw-bone, it turned out that they were cancerous; in another, inflammation of the tissues surrounding the rectum masked a rectal cancer; in a case commencing as simple mumps, and treated as such, it developed concealed cancer of the parotid gland; and in still another, simple inflammation of the lip for some time served to mask the presence of a cancer.

The possibility of malignant disease underlying what appears to be a simple inflammatory process should never be forgotten when the age and appearance of the patient, and the part affected, are such as to make the existence of cancer probable. Dr. Orecchia believes that in these cases the cancer is the primary disease, which, owing to slightness of the symptoms, remains unnoticed till the supervention of inflammation calls attention to the part.

A CORRESPONDENT writes from Paris that a new symptom, characteristic of cancer of the uterus, has been announced by Petit, Troisier, and Raymond, each of whom found the existence of an enlarged lymphatic gland above the left clavicle in cases of cancer of the neck of the womb.

M. PINARD treats cracked nipples with great success as follows: As soon as there are any appearances of cracks, or even tenderness, of the nipples, a compress folded in four, and steeped in boracic acid solution, three or four per cent, is applied. Oil silk is placed over the compress to prevent evaporation, over this a layer of cotton wadding, and the whole secured by a bandage.

M. MONIERE relieves painful menstruation in its most violent forms by giving an enema containing thirty grains each of bromide of potassium and chloral. One-half of this amount to young girls.

IN wound of the abdominal wall, Dr. M. B. Carson, in *Journal of American Medical Association*, says he would, on the first indication of peritonitis, open the abdomen, and keep it thoroughly drained. In cases of hemorrhage after bruise, if the patient survives the shock of the injury, he would open the abdomen, and treat the bleeding directly. In cases of supposed rupture of the bowel, he would operate immediately, "for exploratory laparotomy is far less fatal than the expectant plan of treatment."

PROFESSOR PETRESEN, in *Progrés Méd.*, recommends brionia diocia wine as far superior to ergotine in the treatment of hemorrhage from the womb. Three hundred grains of the root are macerated for eight days in a quart of white wine. Dose, a tablespoonful every hour until the bleeding stops.

PROFESSOR CHOUPPE is credited with stating that antipyrin, when given with ergot, produces painless uterine contractions, and therefore is a most useful combination after childbirth and also in cases of painful menstruation.

BERGMANN, the celebrated German surgeon, recommends (*Deutsche Med. Woch.*) a new treatment of fracture of the patella, by chiselling off an oblique portion of the head of the tibia, along with the insertion of the ligamentum patellæ, so as to let the lower fragment of the patella be easily moved up. Suturing of the fragment is then accomplished. This operation is recommended for cases of non-union after transverse fracture. In recent cases Bergmann empties the knee-joint of blood and serum by aspiration, and then secures rest and apposition of the fragments by splints and elastic bandaging. Early massage of the extensor muscles is advised.

IN applying plaster-of-Paris bandages, the secret is, to have all the sizing taken out of the material used; so that, when a piece of muslin to be saturated is thrown in the mixture of water and plaster, it will readily absorb the same. The plaster will "set" more quickly if a little salt is added. A roller made of lint is regarded as better than cotton next to the part to be plastered.

A REPORT of some successful experiments in purifying water from organic germs is given in the *Annals of Hygiene*.

Specimens of water that were found by the use of a powerful microscope to be full of animal life, disease-germs, etc., were charged with fairly strong currents of dynamic electricity, and then carefully covered, to prevent any contamination from the air.

After fourteen days it was examined again, and not a sign of living animalculæ or disease germs could be found; while samples of water kept in the same way, without being charged with electricity, showed as full of organisms as when first examined. These experiments, which were carried on at Pittsburgh, if confirmed, indicate another among the important and valuable applications of electricity for medical and sanitary purposes.

A PHILADELPHIA physician, says the *Bulletin*, concludes that many headaches are often due to absorption of the lead used in finishing hat-bands. We analyzed a black japanned band worn by a patient suffering from headache, and found it contained three grains of lead salts.

DRYNESS of the mouth, occurring as an affection, more especially in old people, is benefited by jaborandi, according to Dr. Hadden of London.

SPONGY gums, congested or receded, are treated successfully (*Kansas City Medical Index*) by applying glycerole of tannin.

BRIEF inhalations of carbonic-acid gas are said by Dr. E. Weil to relieve cough and difficult breathing.

[Original in *Popular Science News.*]

SOME FACTS CONCERNING BRIGHT'S DISEASE.

BY JOHN CROWELL, M.D.

I.

THE prevalence of Bright's disease in these busy, rushing days of ours has turned the attention of the medical profession to the more minute examination of the nature and cause of the affection; and many interesting facts and conditions have been revealed by the aid of the chemist's tests, the microscope, and pathological studies and comparisons. Ever since the discoveries of Dr. Bright in 1827, there has been more or less helpful literature presented, and recent investigations are suggestive in the diagnosis and treatment of the disease. One important office of the kidneys is to eliminate some of the morbid products of the blood, the result of the disintegration which is constantly taking place in the physical organism. The kidneys, then, in connection with the liver, lungs, the glands of the alimentary canal, and the skin, may be called the scavengers of the body. The lungs eliminate the carbonic acid, the liver the carbo-hydrogen, and the kidneys the nitrogenous products. But there is still another office for the kidneys: they serve as a safety-valve in regulating the quantity of water in the blood. They, with the lungs and the skin, are the only means through which the system has power to remove the water from the vital fluid. Under ordinary conditions each excretory organ is limited to its own special function, yet there are certain complementary relations between them which enable them to render assistance to each other. For example, when respiration is active, the lungs eliminate more carbonic acid, and the liver secretes less bile, which consists largely of carbon Similar relations exist between the skin and the kidneys.

Fresh healthy urine is a clear amber-yellow liquid, of a peculiar, disagreeable odor, and a well-marked acid reaction. If permitted to stand a while, a slight cloudiness appears, consisting of mucus, which forms a sediment. Still later it becomes alkaline, owing to the decomposition of urea into carbonate of ammonia and a precipitate of earthy phosphates. Healthy urine may become turbid soon after being voided, because, in cooling, the urates of soda and ammonia are precipitated, which are insoluble in cold water. The amount of urine passed by a healthy adult in twenty-four hours is about thirty ounces in summer, and forty ounces in winter. The specific gravity varies with the amount of solid food taken, the average for the year being about 10-0, rising to 1025 in summer, and falling in winter to 1015. Of course, these figures vary according to various conditions of diet and habits; and it is interesting to observe that the amount of

urea is always diminished by a vegetable diet, while the quantity of uric acid is not appreciably affected. A knowledge of this fact is important in the treatment of Bright's disease: vegetable diet *increases* the amount of extractive matter in healthy urine, while animal diet *diminishes* it; but the amount of phosphates, lactic acid, and lactates is but slightly changed by an animal or mixed diet.

In testing the urine for albumen, it is always well to employ both heat and nitric acid. Heat alone often separates earthy salts, which to the eye may resemble a slight cloud of albumen, and nitric acid alone sometimes precipitates uric acid, with urate of ammonia in excess. But if the coagulum produced by heat also resist the nitric acid, we may be reasonably sure that we have albumen in the urine. The mere presence of albumen in the urine is not sufficient evidence of Bright's disease: it may accompany cystitis or hæmaturia, or may follow the action of a blister affecting the kidneys, or result from mercurialism, errors in diet, or confirmed dyspepsia. But in all such cases the presence of albumen is only *temporary*, and does not present the diagnostic test of *persistency*.

The question whether albumen is ever found in the urine of persons apparently healthy, in whom no trace of disease can be detected, is receiving some attention, and the recent investigations of Professor Grainger Stewart upon this subject, and communicated by him to the Edinburgh Royal Society, are interesting. He found albumen present in thirty-one per cent of the urines of four hundred and seven healthy persons. These individuals were engaged in a great variety of occupations; but it is worthy of notice that nearly all were of the poorer classes, living under bad hygienic conditions. Thus, in forty children of one of the city poorhouses, 17.5 per cent had albumen; and of forty male inmates, 67.5 per cent. From his observations, Professor Stewart concluded that albumen may be eliminated from the healthy kidney, and is not in itself a sign of disease, and that therefore the presence of albumen in the urine is not a sufficient cause for rejecting a candidate for life insurance. Such deductions are not worth much in establishing a theory, and they should be accepted with caution. Experiments, to be reliable in the premises, should come from a much larger number of individuals living amid the most healthy surroundings, and under the most favorable conditions.

For the present, therefore, it will be safe to adhere to the test that the *persistent* presence of albumen in the urine is a pretty sure indication of albuminuria. But as this is an age of investigation, the practitioner gladly welcomes the results of experiments; and he should not be too slow in accepting theories based upon a broad and intelligent line of study, observation, and experiment.

English and American authorities generally agree in classifying Bright's disease under two conditions, — the acute and the chronic.

Upon the continent of Europe this division is not rigidly followed. The acute form is far less common than the chronic, and is apt to follow the acute stages of smallpox, scarlet-fever, and diphtheria. In scarlet-fever it sets in about the second week in cases where the eruption is not well defined, and is aggravated by exposure to cold and dampness.

In smallpox it occurs during the period of desquamation, and in cases where the system has received a severe shock from the poison. In diphtheria we find it in cases where the system has become very much reduced by the severity of the disease.

In the early stages of this form of the disease, the urine presents a smoky color, having an acid reaction, and a specific gravity ranging from 1025 to 1030. After standing a while, a flocculent, brownish sediment forms, which under the microscope will be found to consist of blood-corpuscles, epithelial cells, free nuclei, coagulated fibrine, and tube-casts, which consist of three forms, corresponding to the three layers of the walls of the uriniferous tubes.

The microscope is necessary in order to detect the diagnostic elements of the casts of the tubuli uriniferi, which constitute a marked feature in this disease. These casts are of four kinds, indicative of different stages of the disease: but sometimes the exudative, desquamative, fatty, and waxy casts are found mingled, one with another, in various proportions; but the predominance of any one kind will enable us to distinguish the condition of the disease. The unfavorable symptoms of the acute form are, increase of albumen, a diminution in the quantity of urine passed, and the elimination of blood, as evinced in the darkened color of the urine, and more clearly revealed by the microscope.

(To be continued.)

THE INFLICTION OF THE DEATH PENALTY BY ELECTRICITY.

In the month of July, 1887, there was conducted a series of experiments calculated to throw considerable light upon the value of electricity in killing dogs.

The electrical apparatus consisted of a common pine box lined with zinc, and connected with one pole of the electric-light current for that portion of the city. When in use, the box was partially filled with water. Connected with the electric-light wire, representing the other pole, was an ordinary dog muzzle, supplied with an iron or copper bit, which was inserted into the mouth of the canine.

The animal being placed in the box, the switch making the circuit was turned, causing the apparent instantaneous death of the animal. Only in exceptional cases were any movements noted after the current was made.

The results obtained by experiments conducted in this manner leaves the subject just where public opinion would place it; viz., that electricity will kill quickly. However, to ascertain how quickly and thoroughly, requires further demonstration.

The heart may rightfully be considered the centre of function, and, in the execution of criminals by the legalized hanging process, is always examined to ascertain when death ensues. In favorable cases it is known that the heart may beat from six to ten minutes, and in some cases it has been known to beat from fifteen to thirty minutes, before death.

To refer to the experiments: A fair-sized dog was placed under the influence of chloroform; an incision was made in the trachea, in which a tube, connecting with the foot-bellows, and supplied with suitable valve for respiratory purposes, was attached. Respirations were then kept up by these artificial means. The chest walls (thorax) were then removed, so that the heart and lungs were exposed to view. The dog was then placed in the zinc-lined box, the muzzle put on, and the forced respiration kept up until just before the current was made. The heart was beating as in life; but, the instant the circuit was made, it ceased its action, and became a mere mass of quivering flesh; not the least resemblance to a rythmical movement was observed after the current was made. The demonstration as to suddenness of stoppage of the heart exceeded all anticipation. The interference with all function was electrically instantaneous; death ensued from electrical shock; the ordiuary conditions of dying were absent. Nothing could be more sudden.

In this second experiment it was also noticed that an attempt to respire was made by the animal after the current was made. This undoubtedly indicated that the respiratory centre in the brain (medulla) had not completely lost its susceptibility to impressions, and that, through the want of oxygen in the blood and centre noted, the effort to breathe was formulated. This has an important bearing upon the apparatus to be used in executions, inasmuch as it indicates that the poles should be arranged to pass the current through the centre of function in the brain. Upon physiological grounds, also, this is indicated.

Even without this refinement of precision in the apparatus, as has been shown in this experiment, where the current was not passed directly through the functional brain centres, the sudden stoppage of the heart would indicate that electricity offers the most rapid agent in producing death that we have at our command. The mere estimates of the difference in the speed of the electric as compared with the nervous current would further indicate that our senses could not interpret or apprehend the passage, or that death produced by such means would be absolutely painless to the culprit.

From these observations the following deductions may be drawn: —

1. That death produced by a sufficiently powerful electric current is the most rapid and humane of that produced by any agent at our command.

2. That resuscitation after the passage of such a current through the body and functional centres of the brain is impossible.

3 That the apparatus to be used should be arranged to permit the current to pass through the centres of function and intelligence in the brain. — George E. Fell, M.D., in *Buffalo Medical and Surgical Journal.*

[Original in *Popular Science News.*]

BUTTERMILK AS A MEDICINE.

BY DR. S. F. LANDREY.

With the rapid growth of reconstructive medicine, comes opportunely the re-introduction of old and well-known domestic remedies, among which buttermilk demands a respectable place. A young lady patient of the writer's was suffering from a severe consumptive cough. None of the usual antispasmodics, expectorants, etc., seemed to do any good, simply because her stomach was too weak to bear enough medicine to effect the purpose. Finally I suggested to her mother the use of hot buttermilk. It was adopted at once. Her first night's experience was one of comparative freedom from cough and pain, and a pleasant slumber for several hours. It was continued for a long time, with an unvarying relief of all her previous distressing symptoms, and an almost perfect freedom from cough for several hours after each draught of the hot buttermilk. Lingering at one time for weeks from an attack of congestive fever, dosed with calomel and quinine almost beyond endurance, the writer began to desire buttermilk to drink. The physician "didn't believe in humoring the whims of pâtients," as he expressed it; besides, he contended that a single drink of the obnoxious fluid might produce death, as acids and calomel were incompatible dwellers in the same stomach. But I was a good persuader, and my mother was a susceptible subject. The buttermilk, "fresh from the churn," was procured and drank. No evil resulted; instead came a perspiration and speedy recovery.

Many years afterward I had missed my usual noon-meal. It was about two or three o'clock P.M. — dinner, of course, was over — when I reached a farmhouse, weak, tired, hungry, and "all out of condition" for active work. Dinner was sug-

gested by the housewife. "No, indeed!" said I, "not this time: I am nearly home. But if you have any buttermilk, I will take a drink of that to stay my stomach." A good, kind-hearted woman, she soon brought up a pitcher of buttermilk from the cool spring-house, while I examined my patients and prescribed for them. Perhaps a pint was drank during the stay of nearly an hour. For months indigestion had held his unfriendly grasp on my stomach. From that notable day forward his reign was broken; my stomach was healed, and I could ride all day, if necessary, without feeling so woebegone from the lack of food as before the drinking of the buttermilk.

There are people, however, who cannot use buttermilk at all, and some who cannot use milk of any kind, nor butter; but to others it proves both food and medicine.

THE PROGNOSIS OF VARIOUS DISEASES.

DR. PYE-SMITH sums up the conclusions arrived at in his paper in the following prognostic aphorisms: —

Epidemic diseases are most fatal when first introduced; acute diseases, following upon chronic, are the most dangerous; a degree of pyæmia which is of slight importance in a child, is grave in an adult, and imminently perilous in an old man.

Typhus fever is most dangerous to persons who have passed their sixtieth or fiftieth year, less so to infants and those between thirty and fifty-five, and least dangerous to children about five and to young adults.

Smallpox in these particulars closely resembles typhus. Whooping-cough is dangerous duriug infancy, and benign after five years of age. Scarlet-fever seldom takes on a malignant form wheu it attacks adults. Acute lobar pneumonia has usually a favorable issue in youth, and is usually fatal in advanced years. In young adults pneumonia is rarely fatal unless the patient has disease of the kidneys or of the heart, or is of intemperate habits. Pneumonia is also a dangerous complication of fevers or acute rheumatism. Acute lobar pneumonia, when not fatal, leaves the lung uninjured after recovery, and the patient in good health. It is seldom or never followed by phthisis, even when it attacks the apex. Primary acute pleurisy is not fatal unless it is accompanied by pericarditis. Pleurisy, if under treatment it ends in death, is secondary to tubercle or to cancer, or to disease of the kidneys. Œdema of the larynx is very seldom dangerous; œdema of the lungs is usually so. Acute bronchitis is a frequent cause of death in young children and old people. Fatal bronchitis in persons between ten and sixty years of age is either capillary, or secondary to tubercle. Phthisis is most pernicious when it is hereditary. Consumptive patients, who lose flesh and color and appetite, with but little signs of disease in the lungs, are in a worse case than those who have marked local symptoms, but whose appetite and nutrition are good. Hæmoptysis, even when copious, is not always of ill omen.

It is rare for hemorrhage from either the lungs or the stomach to be immediately fatal, except it proceed from aneurism. Chronic valvular disease of the heart, when it complicates phthisis, does not aggravate the latter, — rather, it checks its progress. Sudden death is more frequent from aortic than from mitral lesions, in regurgitant than in obstructive disease of the aortic valves, and in stenosis than in dilatation of the mitral orifice. Apoplexy, when ingravescent, is commonly fatal. In apoplectic attacks the ultimate prognosis depends chiefly upon the degree and continuance of unconsciousness, the immediate prognosis upon the degree in which respiration is afflicted. Chronic diseases of the spinal cord are more likely to end favorably in women than in men. Chorea is only fatal when the patient cannot sleep. Malignant tumors are more rapidly fatal in the young than in the old. Cancers in the aged are exceedingly slow in their process, and may even, in rare cases, atrophy. Stone in the kidney may frequently be cured without operation. The opposite is true of stone in the bladder. Diabetes is rapidly fatal when it occurs in young men, more curable in middle life, and of little danger in later years. Diarrhœa is dangerous only in infants and in persons above sixty years of age. — *London Medical Recorder.*

DRUG-STORES IN GERMANY.

THE drug-stores have a curious way here of shutting up just about the time you want them. And as soon as it begins to grow dark, down go the shutters; and if you need any thing, you go to a little bell-handle outside of one of the iron shutters, and ring it. Then you hear some one at a crank inside; the massive frame rolls up, and a head looks out of the window. Finally the man or boy inside opens part of the window, and you talk through a pane of glass, and make known your wants. Instead of getting angry at being aroused, the man begs your pardon for keeping you outside, and says: "I thank you for your order." If you have not the exact change, and the man inside is in the same predicament, he will beg you most politely, and thank you, to allow him to change it. Having done so, he will thank you for calling (evidently taking the visit as a social one), bow, close his little peep-hole, bow again, and then smile sweetly as he grinds down his iron shutter, and his smiling face is lost to view. How different from the druggists in America! I remember I once woke one up in the States, and he came down-stairs with a shotgun after me. But, as I remarked before, they have a curious way of doing things in Dresden.— *Exchange.*

HOW TO TREAT CRAMPS IN THE LEG.

MANY persons of both sexes are greatly troubled with cramps in one or both their legs. It comes on suddenly, and is very severe. Most people jump out of bed (it nearly always comes on either just after going to bed, or while undressing) and ask some one to rub the leg. I have known it to last for hours, till in despair they would send for the family physician; and even then it would be hours before the spasm would let up.

There is nothing easier than to make the spasm let go its hold, and it can be accomplished without sending for a doctor, who may be tired and in need of a good night's rest. When I have a patient who is subject to cramp, I always advise him to provide himself with a good strong cord. A long garter will do if nothing else is handy. When the cramp comes on, take the cord, wind it around the leg over the place that is cramped, and take an end in each hand, and give it a sharp pull, — one that will hurt a little. Instantly the cramp will let up, and the sufferer can go to bed assured it will not come on again that night. For the permanent cure, give about six or eight cells of galvanic battery, with the negative pole applied over the spot that cramps, and the positive pole over the thigh. Give it for ten minutes, and repeat every week for a month.

I have saved myself many a good night's rest simply by posting my patients subject to spasm of the legs how to use the cord as above. I have never known it to fail, and I have tried it after they had worked half the night, and the patient was in the most intense agony. Even in such cases, at the first jerk of the cord all pain left. — R. W. ST. CLAIR, M.D., *in Medical Age.*

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Publishers' Column.

OPINION OF DR. W. C. CAVENAGH, MEMPHIS, TENN. — "For weak digestion, general debility, and want of appetite, I cheerfully recommend COLDEN'S LIQUID BEEF TONIC."

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THE BUFFALO LITHIA WATER, which is advertised in this issue, is spoken of very highly by physicians in the treatment of Bright's disease of the kidneys.

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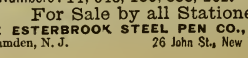

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CONTENTS.

FAMILIAR SCIENCE.—The Surface Tension of Liquids..... 97
Optical Illusions..... 97
Do Birds build by Instinct, or Reason?..... 98
The Golf-Ball's Flight..... 99
American Indian Jugglery..... 99
The Origin of Musk..... 100
Scientific Brevities..... 100

PRACTICAL CHEMISTRY AND THE ARTS.—Gas-Making..... 101
The Pinhole Camera..... 101
A Venetian Ship Railway..... 102
Ancient Materials for Paper-Making..... 102
Detection of Cotton-Seed Oil in Olive Oil..... 102
Industrial Memoranda..... 102
Railroad Notes..... 102

HOME, FARM, AND GARDEN.—Canned Goods..... 103
Artificial Flavors..... 103
Laundry Suggestions..... 104
Yankee versus European Cookery..... 104
Gleanings..... 104

EDITORIAL.—Crystallization..... 105
Berlin Letter..... 106
Astronomical Phenomena for July, 1888..... 107
Meteorology for May, 1888, with that of the Spring..... 107
"How Birds Learn to Sing"..... 108
Questions and Answers..... 108
Literary Notes..... 108

MEDICINE AND PHARMACY.—Urea..... 109
The Rind of Fruit Indigestible..... 109
Some Facts concerning Bright's Disease..... 109
Monthly Summary of Medical Progress..... 110
Care of the Ears..... 111
The Stimulus of a Change of Air..... 111
A New Hypnotic..... 112
Medical Memoranda..... 112
Humors..... 112

PUBLISHERS' COLUMN..... 112

Familiar Science.

THE SURFACE TENSION OF LIQUIDS.

IF we place a piece of camphor upon a clean surface of water, it will begin to move about in various directions, without any apparent cause, and continue this motion for a long while. By gently blowing upon it, the motion may be increased; and, singularly enough, the camphor will move *against* the current of air, being apparently attracted towards its source. The same phenomenon may be observed when the camphor is placed upon a clean surface of pure mercury, previously slightly warmed.

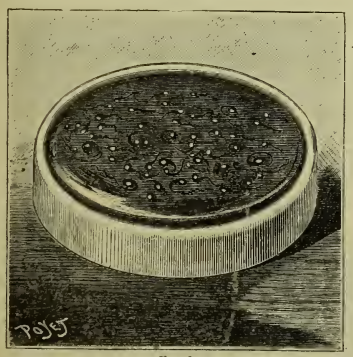

FIG. 1.

The particles dart about in a most curious manner, resembling the movements of little tadpoles swimming in water (Fig. 1). If a drop of oil or any greasy substance is added to the water in which the camphor is moving, it immediately stops.

A curious toy depending upon this phenomenon may be made by bending a piece of tin into the shape of a small boat, which may be provided with a mast and flag (Fig. 2). A piece of camphor is fastened to the stern, and furnishes a motive-power which causes the miniature ship to sail round in a most mysterious manner. The explanation of this phenomenon is rather difficult, and, in fact, is not perfectly understood by any one; but it is undoubtedly due to what is known as the surface tension of liquids.

We know that the surface of all liquids is in a state of tension, like a piece of stretched india-rubber cloth. This surface tension of thin

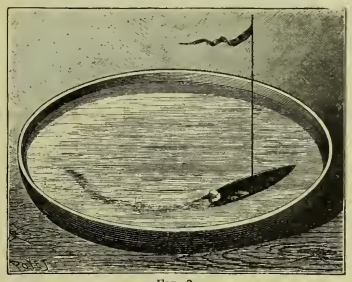

FIG. 2.

films is beautifully shown by a soap-bubble, which, when blown, and allowed to remain on the pipe, contracts upon itself, and gradually grows smaller, like a toy balloon pierced with a small hole. The current of air issuing from the end of the pipe can be felt quite perceptibly, and will affect a candle-flame very strongly.

But this surface tension is not possessed by a hollow sphere alone; the surface of a solid drop of water, or a mass of liquid of any shape, exercises the same force, although it is not evident, on account of the reaction of the interior mass.

This surface tension varies with different liquids, and is greatest in the case of water. If we spread a film of oil, alcohol, or even vapor of camphor, over the water, these films displace the water-film, and reduce the surface tension of the whole to that possessed by themselves alone.

The above considerations offer a very reasonable explanation of the movements of camphor upon water or mercury. Assuming the surface of these liquids to be in a high state of tension, the vapor of the camphor forms a film of lower tension around it, as it rests upon the water. If the tension was reduced regularly in all directions, of course no effect would take place; but, as the vapor tends to spread more or less irregularly, the tension will be greater on one side, and thus cause a movement of the piece of camphor. By blowing upon it, the film of vapor is, of course, directed more strongly in one direction, thus reducing the tension of the water or mercury in the rear, and allowing the water-surface in front to contract more strongly, and pull the camphor against the current of air. The effect can be illustrated by placing a coin upon a sheet of thin rubber stretched across a frame. While the tension remains equal in all directions, nothing takes place; but if we cut through the rubber directly behind the coin, the tension in that direction is destroyed, and the contracting rubber pulls the coin forward.

It is only recently that this phenomenon of surface tension has been fully recognized and studied. It has an important bearing upon the subject of molecular physics, and has a most useful practical application in the use of oil as a means of stilling the waves of a stormy sea, which is undoubtedly caused by the difference of surface tension between oil and water. The subject is a most interesting one, and future investigations upon it may greatly increase our knowledge concerning the constitution of matter in the liquid form.

The accompanying illustrations are from an article upon this same subject by M. Devaux in *La Nature*.

OPTICAL ILLUSIONS.

THE *stroboscopic circles* (Fig. 1) were discovered by Professor Thompson about ten years ago. They are probably familiar to

FIG. 1.

most of our readers: but we may say, that, when the drawing is held before the eyes, and rotated with a sort of *rinsing* movement, the

circles will appear to revolve in the same direction. The explanation of this peculiar illusion is still somewhat uncertain. For our own part, we find it impossible to look at the circles, even when the paper is at rest, without having the impression that the circles are moving, first in one direction, and then in the other, though we have never seen this appearance mentioned before.

A writer in *La Nature* suggests several in-

FIG. 2.

teresting variations which may be given to this experiment. If a spiral or rose-shaped design (Fig. 2) is substituted for the concentric circles, they will also appear to rotate when the paper is moved as before; but the revolutions will be in the *opposite* direction to the movement of the paper. The remaining two designs are intended to be copied on cardboard three or four times larger than the original, and rapidly revolved on a pin or wire passing through the centre. Under these conditions

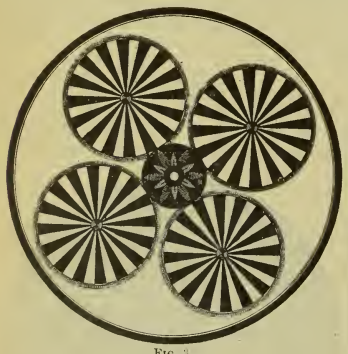

FIG. 3.

Fig. 3 will be curiously transformed. The four circles will disappear, and change into a single circle the circumference of which is bounded by the centres of the real circles; outside of this spectral circle numerous half-circles appear. When Fig. 4 is rotated on its axis, the parallel lines disappear, and become converted into concentric circles.

Although the effect is much better if the designs are enlarged, the illusions can be observed very well with those of the size given. Figs. 3 and 4 can be cut out, and attached to the end of a pencil with a little paste, when they can be readily rotated, and will show quite clearly the transformations described above.

[Original in *Popular Science News*.]

DO BIRDS BUILD BY INSTINCT, OR REASON?

BY SAMUEL BRAZIER.

IN his *Reign of Law*, the Duke of Argyll, in arguing in favor of the theory of intuitive ideas, says: "Among the lower animals, young ones taken from the litter or nest, and brought up under conditions wholly removed from the teaching of their parents, whether by imitation or otherwise, will reproduce exactly all those habits of their race which belong to their natural modes of life." How much is meant by the words "exactly all those habits of their race" is not clear. If it should be taken to imply that young birds taken from the nest when only a few days old, and left entirely to their own instincts, will build nests exactly like those built by their parents, it is entirely at variance with facts. Birds have frequently been reared away from their parents, but when supplied with the proper materials have never been found to

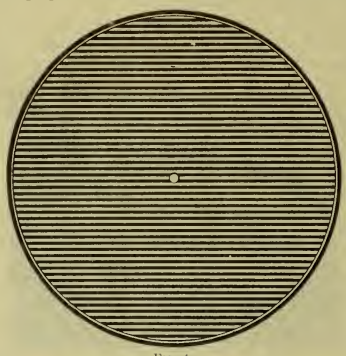

FIG. 4.

build the style of nest peculiar to their tribe. There is less foundation, in fact, than many would at first be disposed to admit, for the general impression that birds build the same kind of nest from generation to generation, and are incapable of building any other; their style of nest-building being regarded as the gift of nature, as much as the color of their plumage.

A marked contrast is supposed to exist between the building of nests by birds and the building of dwellings by men. Birds are thought to build by instinct, and therefore build forever on the same plan, never vary, and are incapable of improvement. Man, on the other hand, builds by reason, and therefore changes his style, and continually advances and improves. Nest-building is the result of instinct, and is stationary: human architecture is the result of reason, and is progressive. These are the generally received opinions, and, like many general conclusions, have been arrived at without due regard to facts. So far is this wide contrast between man and birds from being well established, that facts seem to point to the conclusion, that, in building their dwellings, men are as much the creatures of instinct as the birds; and the birds are as much governed by reason, though of a lower kind, as man. Similar facts to those which lead to the belief that birds build by instinct apply to many tribes of men, and in a degree to all men; and similar facts to those which are urged to show that man builds by reason, and therefore, under altered conditions, alters and improves his dwellings, apply also to birds.

Men, as a rule, build their dwellings with those materials which abound most in those districts where they have settled, and are easiest to use. Sometimes it is a mere shelter of leaves, or a hole burrowed in the earth. In tropical countries where forests abound, the broad palm-leaf and the bamboo afford the most convenient materials for building. The Esquimaux and the Egyptian peasant have neither palm-leaves nor bamboo: but the one has plenty of snow, and the other has plenty of mud; and with these they construct their dwellings. It is so among birds. The kingfisher uses the bones of the fish it has eaten; the rook finds roots and fibres for its nest where it finds its food, —in the ploughed fields; the lark also builds its nest with grass, and lines it with horse-hair; the crow finds fur and wool where it finds carrion; and the swallow finds abundance of mud on the banks of rivers and ponds, where it is attracted by a plentiful supply of insect-food. A more extended inquiry than is attempted here would show that in the choice of materials for building, birds are governed as men are, partly by necessity, partly by convenience, and partly by the force of long usage.

But it may be urged that man reasons, and therefore alters and improves his dwellings as occasion requires. This is only partly true as regards man, and it is to some extent true as regards birds. In some cases men have continued to build the same kind of dwelling generation after generation for ages. The Arab continues to live in tents, as he did thousands of years ago. The Patagonian continues to build a rude shelter of leaves which could never have been inferior to what it is to-day. The huts constructed by many savage tribes of men show no more signs of improvement than the nests of birds. The mud villages on the banks of the Nile to-day are probably no better than those which were built by the generations that raised the pyramids. Even the Scotch crofter's cabin, the hut of the Highlander, or the Irishman's turf cabin, are very much what they were a thousand years ago. And savages and semi-civilized tribes of men sometimes continue to construct a particular kind of dwelling long after any necessity for it has passed away. The Malay Islanders, for instance, construct very slight dwellings with bamboo, and build them on posts a great height from the ground. There is no special reason why they should not build on the ground. The probability is, that they have migrated from some lake district where their ancestors were obliged by circumstances to construct dwellings of this kind.

Now, although certain races have continued to build the same kind of dwelling for thousands of years, it is not inferred that they build by instinct. It is simply attributed to the force of hereditary custom. On the other hand, because birds, feeding on the same kind of food, and living under similar conditions, are observed to build the same kind of nest as their ancestors, it is supposed that they are directed by instinct, and can never alter or improve their dwellings.

That young birds should build the same kind of nest, and use the same materials, as their parents, is the most natural thing in the world. It would be most surprising if it were otherwise. The young birds living in the nest till they grow strong enough to leave it, and learn to fly, then returning again and again to it, must certainly learn something of its construction, and would probably often see the parent birds at work repairing it. When they come to want a nest of their own, they find in their habitat the same kind of materials as were used in the old nest.

What is more natural than that they should

proceed to use them, and to use them in the same manner as they had seen them used. Probably young birds receive instruction, and maybe assistance, from the parent birds in the art of nest-building. It is further probable that a young bird does not always mate with one of the same age. A bird of last summer may mate with one of this, and bring experience to the happy labor of constructing a home. With its knowledge and experience of one kind of nest, and finding the materials in its daily search for food, it would be strange, indeed, if it should go out of its way to find different materials, and attempt to construct its nest in a different manner. Such originality on the part of birds would be greater than is found among savage men. The South-American shows no disposition to resort to clay or sun-burnt bricks, or stones and turf, in place of the palm-leaves with which he builds his hut.

When necessity or convenience has directed man to one kind of materials with which to construct his dwelling, and one particular mode of building has been sanctioned by long usage, he is very slow to change, even when altered conditions render the old method inconvenient. The inability readily to depart from old customs is no less strange in birds than in man; yet that birds do change and improve their dwellings when necessity requires, is well established by facts. The house sparrow originally built in trees, and does so now; but when houses were first built, he was able to adapt himself to new circumstances, and is not slow now to utilize any convenient spot that affords good shelter for his young, and saves him the trouble of building a more elaborate nest, such as is necessary when he builds in a tree. The chimney and house swallows have in like manner changed their habits The purple martiu and other birds have no objection to use the boxes that are sometimes put up for them. Wrens will build in cigar-boxes placed in convenient spots, and a robin has been known to utilize an old tin or kettle. As the swallow and the sparrow have shown a liking for human dwellings, so from time immemorial the jackdaw has taken to church steeples, which is to be explained neither by mere instinct uor by his theological opinions. Birds not only change the situation, but will also alter the style, of their nests, making them slighter or more compact and strong, shallower or deeper, as circumstances demand.

The little gold-crested warbler makes a perfect dome to its nest in exposed situations, and has the entrance at the side; but when it builds in a situation where no dome is required, it builds an open cup-shaped nest. Mr. Wilson strongly insists that the Baltimore oriole improves in nest-building by practice, and that the older birds make the best nests.

The lark did not always line its nest with horse-hair; and, in place of hair, or wool, or vegetable fibre, birds have been able readily to utilize worsted, thread, silk, bits of cloth, and other materials, about which original instinct could teach them nothing.

Modern civilization has been unable to create any distinctive style of architecture. We have what we have borrowed, — the Egyptian, the Gothic, the Grecian, the Roman. These may be instanced as vastly superior to any thing that has ever been developed among birds, and as demonstrating the differences between the results of reason and those of instinct. But man is capable of adapting himself to more varied conditions than the birds, and draws his knowledge and experience from a wider field. By war and conquest and by migration different races are mingled together, and the habits and customs of one nation are modified by those of another. Man has learnt his architecture as he has learnt other things, — by this mingling of races. And the contrast is not so great as at first sight appears. The nests of some birds are so wonderfully and skilfully made, that the contrast between them and the lowest human habitation, on the one hand, is greater than between these nests and the finest human architecture on the other. If the nest of the tailor-bird is the result of instinct, can the hole in the ground made by the South-African Earthman be the result of reason? It is less a question of kind than of degree. The contrast is not between reason and instinct, but between a higher and lower kind of reason. Birds, like men, though in a less degree, are wise enough to alter the situation, the mode of building, and the material of their dwellings, and to improve them in obedience to changed conditions.

6 Allston Place, Boston, *June* 1.

[Communicated to the *Popular Science News.*]

THE GOLF-BALL'S FLIGHT.

A seeming paradox is met with when a golf-player assures one that a properly "driven" golf-ball, after proceeding with an apparently equable motion over the first part of its flight, acquires at a later stage an additional impulse which enables it to describe the last part of its mid-air course with a velocity which is evidently greater than that which it has been just previously travelling under Investigation for one's self, or inquiry from any intelligent golf-player, will convince one that this statement is borne out by the fact. Let us see what the theoretical reasons for this peculiarity are.

The ball is so placed on the ground with reference to the player, that the blow is struck when the lowest part of the curve is being described by the golf-club in the hands of the player. In consequence of this, the direction of the impelling force is horizontal: yet a "well-driven" golf-ball starts in its flight at an augle of from 20° to 30° with the horizon; then it must be, that this horizontally delivered blow is applied to the surface of the ball as much below the horizontal line passing through its centre as the liue of flight is elevated above the horizon. It is evident, that, as the force is not applied at such a point that the prolongation of its direction would pass through its centre (assumed to be its centre of gravity as well), there will be evolved a motion of gyration about some point, generally near the upper surface of the ball at starting, and never at its centre. Let us assume that the impelling force has been so applied that the gyratory motion is about that point of the ball which is at the surface vertically over the point on which it is resting; then the path traced out by this point in its flight will be the apparent path of the ball, and that gone over by the centre of gravity its true path, an inverted curtate-cycloid.

It will be evident that the greater the number of gyrations in proportion to the velocity of the ball's flight, the greater the difference between the apparent and true path. If we assume that the ball gyrates once in going twice the length of its own diameter, there will be two instants, separated by half the total period we are considering, in which the ball will be in exactly the same place, excepting that the point of gyration will now be in advance of its previous position a distance equal to the ball's diameter. It is evident, from this possible case, that a large proportion of the impelling force of the blow is being absorbed in carrying the ball, or its centre of gravity, through this true path; and it will be equally evident that if, by auy means, this gyratory motion, which, as pointed out, is the cause of the difference between the true and apparent paths, could be arrested, there would be available just the amount of energy toward accelerating its flight that is absorbed in gyration. Such a means is present in the resistance that the ball experiences from the atmosphere in its flight, but not *ipso facto*, because the resistance that the ball experiences in one part of its gyration *as a ball* is practically equal to the acceleration it is in receipt of in the correspondingly opposite portion, and in such a case this gyration would be maintained throughout its flight: but if we consider the ball as an arm or radius turning about the point of gyration whilst being impelled forward, we see that the atmospheric resistances at different parts of the radius are unequal, — at one extremity being equal to the resistance of the atmosphere due to the flight of the ball, *plus* that due to the velocity of rotation; whilst at the other, situate at the point of gyration, it is merely equal to that due to the first cause. Dividing our radius equally at the point that will coincide with the centre of gravity of the ball, which we will now suppose contains this radius as a diameter, we have two levers of equal length on which the atmospheric resistances are unequal, and of such a nature that we can represent their effect by supposing a single force as acting on the extremity next to the point of gyration in opposition to this gyratory tendency, equal in amount to half the difference of the total resistances on each of our equal levers. The result of this will be the conversion of the gyratory motion into an impelling force; for the lost motion in one direction must be apparent in the other, as none of it has been absorbed by the atmospheric resistance occasioned by the flight of the ball, as that, whether the ball is gyrating or stationary, is equal in both cases, and follows the same law.

We can therefore see how, if a golf-ball or any spherical projectile in its flight gyrates about any other than its centre of figure and gravity, in any plane other than one at right angles to the line of its flight, its path will be that of a curtate-cycloid, modified in so far that, instead of being described off a fixed plane, it is described from the parabolic curve of its apparent flight; and how the forces expended in developing the true path are converted without diminution into a corresponding one in the direction of the line of flight, which will result, at the instant of conversion, in a sensible increase in its velocity, as at first stated.

W. A. Ashe, F.R.A.S.

The Quebec Observatory, *May*, 1888.

AMERICAN INDIAN JUGGLERY.

The feature of the evening at one of the late meetings of the Washington Anthropological Society was a paper by Col. Garrick Mallory on "Algonkin Glyps on Bark and Stone." The paper also dealt briefly with some related subjects, and will form a part of the annual report of the Bureau of Ethnology. The following is a brief chapter on "Indian Jugglery," extracted from this paper: —

"Paul Beaulieu, an Ojibwa of mixed blood, present interpreter at White Earth Agency, gave me his experience with a Jossakeed, at Leech Lake, about the year 1858. The reports of wonderful performances reached the agency, and, as Beaulieu had no faith in the jugglers, he offered to wager one hundred dollars, a large sum, then and there, against goods of equal value, that the juggler could not perform satisfactorily one of the tricks of his repertoire to be selected by him (Beaulieu) in the presence of himself and a committee consisting of his friends.

"The wager was accepted, with the result to be described.

"A medicine lodge was made. Four strong poles were planted deep in the ground, rising to an elevation of at least ten or twelve feet; one of them

having the branches remaining and rising a little beyond its fellows, this being the indication of a Jossakeed as distinguished from a Medé lodge. The interior diameter was less than four feet. The frame, which was inclined to the centre, was then filled in with intertwined twigs, and covered with blankets and birch-bark from the ground to the top, leaving an orifice of about a foot in diameter open for the ingress and egress of spirits and of the objects to be mentioned, but not large enough for the passage of a man's body.

"At one side of the bottom wrapping a flap was left for the entrance of the Jossakeed or Shaman.

"A committee of twelve was selected to see that no communication was possible between the Jossakeed and confederates. These twelve men were reliable people, one of them being the Episcopal clergyman of the reservation. The spectators were several hundreds in number, but stood off, not being allowed to approach.

"The Jossakeed then removed his clothing, until nothing remained upon his person but the breech-cloth. Beaulieu then took a rope (of his own selection for the purpose), and first tied and knotted one end about the ankles; the knees were then securely tied together; next the wrists; after which the arms were passed over the knees, and a billet of wood passed under the knees, thus securing and keeping the arms down motionless. The rope was then passed around the neck again and again, each time tied and knotted, so as to bring the face down upon the knees.

"A flat river-stone of black color — which was the Jossakeed Manedo, or amulet — was left lying upon his thighs. The Jossakeed was then carried to the lodge, placed inside upon a mat on the ground, and the flap covering restored so as completely to hide him from view.

"Immediately loud thumping noises were heard, and the framework began to sway from side to side with great violence; whereupon the clergyman remarked that this was the work of the Evil One, and it was no place for him: so he left, and did not see the end. After a few minutes of violent movements and swaying of the lodge, accompanied by loud inarticulate noises, the motions gradually ceased, when the voice of the juggler was heard telling Beaulieu to go to the house of a friend near by, and get the rope. Now, Beaulieu, suspecting some joke was to be played upon him, directed the committee to be very careful not to permit any one to approach while he went for the rope, which he found at the place indicated, still tied exactly as he had placed it about the neck and extremities of the Jossakeed. He immediately returned, laid it down before the spectators, and requested of the Jossakeed to be allowed to look at him, which was granted, but with the understanding that Beaulieu was not to touch him.

"When the coveriug was pulled aside, the Jossakeed sat within the lodge, contentedly smoking his pipe, with no other object in sight than the black stone Manedo.

"Beaulieu paid his wager of one hundred dollars. An exhibition of similar pretended powers, also for a wager, was announced a short time later at Yellow-Medicine, Minn., to be given in the presence of a number of army people; but at the threat of the grand medicine-man of Leech Lake bands, who probably objected to interference with his lucrative monopoly, the event did not take place, and bets were declared off.

"At Odanah, on the Bad River Reservation, and at Bayfield, both in Wisconsin, I obtained some variants of the above performance as seen at different times and places and by several witnesses. For instance: the Shaman at one time was tied up much as before mentioned, but with all of his clothes on; a fish-net, however, being tied above his clothes, enveloping the whole person; and horse-bells were attached to his body, so as to indicate any motion. When examined afterwards, the clothing had been entirely stripped from his person, the nets and ropes and bells placed in a separate pile in the lodge, and the clothing itself was found by direction under a designated tree a mile off; the Indians of the committee, one of whom was my informant, running from the lodge at their highest speed to the tree, and there finding the clothing, and stating the impossibility of its being transported by any human agency in advance of their arrival. In another case, occurring at night, two lodges were built about twenty feet apart. About a hundred Indians surrounded the space occupied by the two lodges with lighted torches giving the brightness of day, and a line of bonfires was built and kept in flame over the space intervening between the two lodges. The levitation in this case was by the bound Shaman in one lodge being found unbound in the other.

"It should be noted that these stories relate to a time some forty or fifty years ago, before the tricks similar to those of the Davenport brothers had become knowu in the civilized portions of the United States. It is a still more important fact that the French missionaries in Canada, and the early settlers of New Eugland, describe substantially the same performances when they met the Indians, all of whom belonged to the Algonkin stock So remarkable and frequent were these performances of jugglery, that the French, in 1613, called the whole body of Indians on the Ottawa River, whom they met at a very early period, 'the sorcerers.' They were the tribes afterwards called Nipissing, aud were the typical Algonkius. No suspicion of jugglery in the sense of deception appears to have been entertained by any of the earliest French and English writers. The severe Puritan aud the ardent Catholic both considered that the exhibitions were real, and the work of the Devil. It is also worth mentiouing that one of the derivatious of the name 'Mic-mac' is connected with the word meaning 'sorcerer;' so that the known practices of this character having an important effect upon the life of the people extended from the Great Lakes to the extreme east of the continent. It was obvious to me, in cross-examining the various old meu, that the performances of jugglery were in each case an exhibition of the pretended miraculous power of an individual, whereby he obtained a reputation above his rivals, and derived subsistence and authority by the selliug of charms and superhuman information. The charms of fetiches, which still are sold by a few who are yet believed in, are of three kinds, — to bring death or disease on an enemy, to lure an enemy into an ambush, and to create sexual love." — *Science.*

[Translated from *Le Franco Americain.*]

THE ORIGIN OF MUSK.

BY W. P. UNGERER.

EVERY one knows the odor of musk, but every one does not know that it is the product of a secretion of the musk-deer.

This auimal is regarded by certaiu naturalists as a species of gazelle; it is about the size of a roebuck, and of a gentle aud timid nature. Its movements are quick, lively, and graceful; but it is especially distiuguished by a little sac situated uear the navel, and containing the much-prized musk, which is secreted as a kind of clotted and fatty humor of a brown color, much resembling dried blood. It is only found in adult males.

Four kinds of musk are distinguished iu commerce, — that from China or Tonquin, which is considered the best; that from Yunnan; that from Assam; and the Kabartine musk, from Russia and Siberia.

It appears, notwithstanding the opinion of Cuvier, that many other species of this family are provided with a musk-pouch, which may explain the differences presented by the various samples met with in commerce.

The price of musk is from eight to twenty dollars an ounce in the natural pouches. This high price is a strong temptation to fraud; and the musk is often found mixed with lead, iron, copper, sand, dried blood, or even paper and rags, to increase the volume and weight. After the introduction of the foreign bodies, the pouches are closed up again in so ingeuious a manuer, that only the eye of an expert can discover the fraud. The purest musk, and that most valued by the Chinese themselves, is that voided by the animal upon stones or trees.

The odor of musk is perhaps the strongest of all known perfumes. Only a minute quantity is necessary to perfume a large quantity of other material. It is of an incalculable divisibility. If one opens a bottle containing this perfume, the whole surrounding air is saturated with its odor, which may be carried by the wind for long distances.

Musk was well known to the ancients, and was highly prized by them as a medicine, as it still is among the Oriental nations. About six hundred pounds are annually consumed in the United States, of which ninety-eight per cent is used in perfumery, aud the remainder in mediciue.

SCIENTIFIC BREVITIES.

SPEED OF TELEGRAPHY. — When the first electric telegraph was established, the speed of transmission was from 4 to 5 words a minute with the five-needle iustruments; in 1849 the average rate for newspaper messages was 17 words a minute; the present pace of the electric telegraph between London and Dublin, where the Wheatstone instrument is employed, reaches 463 words: and thus what was regarded as miraculous sixty years ago has multiplied a hundred-fold in half a century.

METEORITES. — From an exhaustive study of the very large collection of meteorites at Harvard College, the couclusion has been arrived at that many of the masses of meteoric irou now known are cleavage crystals, broken off, probably, by the impact of the mass agaiust the atmospherc. It is found that these uasses show cleavings parallel to the planes of all the three fundamental forms of the isometric or regular system. From all that appears, the theory has come to be entertained, in respect to the origin of meteorites, that the masses were thrown off from a sun among the fixed stars, and that they were slowly cooled while revolviug in a zone of iutense heat.

A REASONING LOBSTER. — A curious story is told by Willard Nye, juu., iu the *Bulletin* of the United States Fish Commission. The sagacious crustacean's home was under a rock in Buzzard's Bay, in water about five feet deep. The author carefully adjusted a noose over the hole, and baited it with a piece of menhaden. The lobster passed its claw through the noose to get the bait; and the noose was drawn upon the claw, but slipped off when the animal had been pulled half out of his hole, and he escaped. The noose was fixed again; but this time, instead of putting out his claws, as before, the lobster first put his feelers through the noose, felt the string all the way around, and then pushed one claw uuder the string and seized the bait. The experiment was repeated several times; but every new setting of the trap was met in the same deliberate way, as if by one who had thought the matter out.

Practical Chemistry and the Arts.

GAS-MAKING.

The methods of artificial illumination have kept pace with the modern improvements in many other directions. The early settlers of this country were obliged to carry on their work or amusements during the long winter evenings by the light of the resinous pine knot or home-made tallow dip, both excellent devices for producing a minimum of light and a maximum of bad-smelling vapors. The introduction of lard and whale-oil lamps was but a slight improvement; and not until the discovery of petroleum, was it possible for the dweller in the country to have his home made bright and cheerful during the hours of darkness. About the beginning of the present century it was discovered that a brilliant illuminating gas could be distilled from bituminous coal, and the manufacture of this gas rapidly spread, until at present there is hardly a city or large town in the civilized world which is not provided with gas-works, which furnish this safe, brilliant, and convenient light at a cost within the reach of every one.

The first inventor of practical gas-lighting was a Cornishman named William Murdock, who in 1792 lighted his workshop with gas obtained from coal, although the principle was suggested as early as 1727. In 1812 the streets of London were first lighted with gas; and since that time it has come into universal use, although during the past few years it has to a limited extent been superseded by the more costly but in some respects more desirable electric light. It will be a long time, however, before electricity can replace gas as an illuminant for houses and detached buildings where expense is a consideration.

The principle of gas-manufacture is very simple, but there are many practical details which complicate the actual process. It depends upon the fact, that, when bituminous coal containing carbon and hydrogen is subjected to heat in a retort, it is partially decomposed, giving off gaseous hydrocarbons and other products, and leaving behind a mass of carbon commonly known as *coke*. But many other compounds are formed at the same time, which must be separated from the gas before it is fit to be sent into the pipes, and delivered to the consumer.

The products of the distillation of coal may be divided roughly into four classes, — coke, coal-tar, ammoniacal liquor, and illuminating gas. Coke contains from ninety to ninety-five per cent of pure carbon, the remainder being ash and sulphide of iron. The ammoniacal liquor contains at least five different salts of ammonia. The coal-tar contains about forty different liquid and solid hydrocarbons, and the illuminating gas twenty-five or more gaseous hydrocarbons, — a total of over seventy distinct chemical substances, all produced by the distillation of a piece of soft coal. It must be remembered that few or none of these exist by themselves in the coal, but are all formed by the chemical reactions which take place during the distillation.

The retorts in which the coal is distilled are made either of cast-iron or fire-clay; they are about nine feet long and one and a half feet in diameter. After being filled with coal, they are raised to a red heat, or even higher. The impure gas thus formed passes off through an upright pipe, which connects with a horizontal one partly filled with water, known as the hydraulic main. The pipe from the retort dips under the water, so that all the gas must pass through it. The coarser and less volatile impurities, including a large proportion of the tar, are condensed in this main. The gas, however, is still at a high temperature, and very impure: so it is sent through a set of vertical pipes connected with each other like a steam-radiator, which are either exposed to the air, or cooled artificially. Many of the impurities are condensed and separated from the gas in the cooler, but it is sometimes still further purified by being passed through large iron vessels filled with lumps of coke over which a stream of cold water is constantly flowing. This still further purifies the gas, especially by absorbing the ammoniacal compounds; but the offensive and dangerous sulphur compounds remain, and to remove these the gas is sent through large iron boxes containing movable trays covered with moist, freshly slaked lime. The lime absorbs the greater part of the compounds of sulphur, and the gas is then ready to be stored in the large holders, improperly called gasometers, and from thence delivered to the customer. After absorbing the impurities, the gas-lime, as it is called, possesses a most horrible odor, and in thickly settled localities its disposal without creating a nuisance is an important and sometimes a difficult matter. A more effective and simpler means of purifying gas is much to be desired.

What is known as water-gas has been substituted to some extent for that distilled from coal. It is essentially a mixture of hydrogen and carbonic oxide, and is formed by a curious reaction which takes place when steam is passed over red-hot coals. The steam is decomposed, and hydrogen is set free, while the oxygen unites with the carbon of the coal to form carbonic oxide (CO). As this gas burns with a non-luminous flame, it must be "enriched" with light-giving hydrocarbons, which are usually obtained from the distillation of crude petroleum. It is claimed that this gas is much cheaper than that produced by the old process; but practical trials have not as yet confirmed this, and the presence of the highly poisonous carbonic oxide renders it a much more dangerous agent to introduce into dwellings. Numerous fatalities have occurred from the accidental escape of this gas into sleeping-rooms, and it has been clearly proved that its poisonous properties greatly exceed those of the common coal-gas. It has also a less characteristic odor, thus preventing the early discovery of an accidental escape or leak, to say nothing of the increased danger to "the man who blows out the gas," who is still to be found in this country, as an eminent member of Congress has recently exemplified.

THE PINHOLE CAMERA.

Having recently had occasion to take several photographs, using a pinhole as a substitute for a lens, I was much surprised at the distinctness of the images. The resulting negative is, of course, not as sharp, and a silver print from it would not look quite as well, as if taken with a lens; but for bromides, where the detail required is not so great as for silver prints, very satisfactory results may be obtained. I have recently taken a number of photographs with pinholes of various sizes, and the following facts have been deduced: (1) The distance from the hole to the plate may be as short as desired, but should not exceed twelve inches (2) The shorter the distance, the better the definition. (3) The size of the hole is regulated by the distance. For a distance of twelve inches the best results are obtained with a hole measuring three-hundredths of an inch in diameter. If smaller than this, the image is blurred by diffraction; if larger, the image is likewise blurred. But for most purposes where shorter foci are used, we may lay it down as a rule that the aperture should in no case exceed one-fiftieth of an inch, nor be much less than a hundredth of an inch. As regards exposure with a hundredth of an inch aperture and a focus of three inches, on a sunny day with a rapid plate, one should give about ten seconds. So that, although the exposures are longer than with a lens, it will be seen that they are by no means excessive.

The pinhole may be made in a piece of black paper, or in a piece of thin sheet metal, which should afterward be thoroughly blackened. In either case the burr must be carefully removed. A simple method of avoiding the burr is to burn the hole in paper with a red-hot needle.

The advantages of the pinhole camera are: (1) that, doing without the lens, one saves weight and expense; (2) that one can take as wide an angle as the camera will admit of — say, 120° on the horizon, against 80° to 85° with a wide-angle lens; (3) that all objects, near and far, will be in equally good focus; (4) that one may suit the size of the image to fit the plate, without changing one's point of view; (5) that one may take a view, if necessary, directly toward the sun, as there is no trouble from fogging caused by the sun illuminating the surfaces of the lenses. Indeed, very satisfactory photographs may be secured, showing the sun in the picture. In this case, however, the sun takes black instead of white, owing to the reversal caused by over-exposure. Finally, while not advising photographers to throw away their lenses, and substitute pinholes, I wish to call their attention to the fact that the pinhole picture is not a thing to be wholly despised, and that there may occur circumstances under which the pinhole may prove a very useful auxiliary.

The pinhole principle may also be used for another purpose, more amusing, perhaps, than artistic, which was first suggested to me by Mr. J. R. Edmands. Let us substitute for the lens a narrow vertical slit, about three inches long by one-fiftieth of an inch wide, made by pasting two strips of black paper side by side. About two inches behind this arrange a horizontal slit of the same dimensions; two inches behind this, place the sensitive plate. The apparatus is analogous to two cylindrical lenses of different foci placed at right angles, but is more readily adjusted If an exposure is now made, we shall find every thing distorted to twice the size horizontally that it is vertically. By

turning the camera on its side we get a vertical distortion. By inclining the slits at different angles, variously distorted pictures may be obtained. — WILLIAM A. PICKERING, *in Anthony's Bulletin.*

A VENETIAN SHIP RAILWAY.

AN interesting achievement of the fifteenth century was recently described by Mr. E. L. Corthell before the Engineers' Club of Philadelphia. Brescia, an inland city of immense strength, was besieged by the Milanese. Upon Lake Garda, near it, were the fleets of the besieging forces. About a hundred miles distant was Venice, apparently unable to cope with the problem of relieving Brescia. An engineer named Sorbolo proposed to the Doge and Senate to take a fleet of war-ships up the Adige to the limit of navigation, and thence to transport them overland to Lake Garda. By exhibiting a model of his proposed apparatus, he succeeded in inducing them to try his project. A fleet of two first-class and four second-class galleys and of twenty-five light barques was prepared, armed, and provisioned. They were taken up the Adige against its impetuous current until the point nearest the lake was reached. Here they were placed on cradles while afloat, and by the power of a regiment of oxen were drawn up the incline to the plain. Six hundred oxen were required to effect this for each galley; but, once on the level, half that number could draw the largest ship. The ground was frozen hard, and for thirty miles was level, and the galleys were drawn in an imposing procession by nearly three thousand oxen over the thirty miles, until Mount Pineda was reached. The army accompanying the ships were provided with tools, crowbars, shovels, and the like, so as to remove obstructions. When Mount Pineda was reached, a roadway was made over it; and by windlasses the ships were hauled up on one side, and lowered down the other, only one coming to grief. As they ascended, they were wedged foot by foot, to prevent an escape. On the descent the one unfortunate vessel broke loose, and was dashed to pieces. The other vessels accomplished the descent in safety, and crossed the remaining space of twelve miles; and in February, 1439, the entire fleet was afloat on the waters of Lake Garda. A second fleet was successfully sent there by the same route a year later. The work was done under the superintendence of Sorbolo, the originator of the scheme.

The vessels were of no inconsiderable size. The largest were nearly a hundred and fifty feet long and about forty feet wide. The success of such an operation before the days of steam and railroads is an augury for the success of ship railways. In the four and a half centuries that have elapsed since then, the size of ships has not increased so rapidly as have the resources at the disposal of engineers for their land transportation. — *Scientific American.*

ANCIENT MATERIALS FOR PAPER-MAKING.

IT has been generally believed that linen rags have been used in the manufacture of paper only since the fourteenth century, and that previously to that the writing materials of the East were chiefly made from unmanufactured materials. This view must be considerably modified in consequence of a careful microscopical examination, made by Dr. Julius Wiesner, of the paper from El-Faijûm, preserved in the Austrian Museum at Vienna in the collection known as "Papyrus Erzherzog Rainer." Many of these papers extend to the ninth, and some are even as old as the eighth, century. The papers are all "clayed" like modern papers.

Dr. Wiesner's examination gave the unexpected result that these papers were all manufactured from rags. The fibre is mainly linen, among which are traces of cotton, hemp, and of some animal fibre: well-preserved yarn-threads are of very frequent occurrence. The manufacture of paper out of rags is not, therefore, as has hitherto been supposed, either a German or an Italian invention, but is an Eastern one. In addition to the Faijûm papers, he examined also more than five hundred Oriental and Eastern specimens from the ninth to the fifteenth century, not a single one of which was a raw-cotton paper; all were manufactured from rags, the chief ingredient being linen.

The examination of the substance used for "claying" gave equally unexpected results. In all the Faijûm papers this was found to be starch-paste, — a substance which had been supposed not to have been used for this purpose before the present century. Animal substances do not appear to have been employed for "claying" before the fourteenth or fifteenth century. In some instances well-preserved starch-grains were mingled with the paste; these agreed, in the form and size of the grains, with wheat-starch, and were evidently prepared starch separated from the meal. In two papers belonging to the tenth and eleventh centuries buckwheat-starch was found, and the cultivation of this substance must therefore be dated back to the tenth century. The object of the "claying" was apparently to increase the whiteness of the paper. — *Pharmaceutical Journal.*

DETECTION OF COTTON-SEED OIL IN OLIVE-OIL.

IN a porcelain capsule holding about 1 liter, 15 cubic centimeters of the oil in question are heated to 110°. Then, whilst still continuing to heat, we pour upon the oil a mixture of 15 cubic centimeters of a solution of soda at 40° Baumé in distilled water and of 15 cubic centimeters of alcohol at 92 per cent. When the mass has become homogeneous, we add, drop by drop, so as not to cool the paste, and form clots, about ½ liter of distilled water. After boiling for a few minutes, we separate the fatty acids by means of pure sulphuric acid diluted to one-tenth. As soon as the separation is complete, and the sulphuric acid is in slight excess, 5 cubic centimeters of the hydrated fatty acids are collected with a silver spoon, and poured at once into a test-tube about 3 centimeters iu diameter and 12 in length. We add 20 cubic centimeters of alcohol at 92 per cent, and heat slightly in the water-bath to dissolve the fatty acids. When the solutiou is effected, 2 cubic centimeters of silver nitrate (30 grams in 100 cubic centimeters of distilled water) are added, the tube is placed in the water-bath, and heated until about one-third of the mass is evaporated. The tube is then removed from the water-bath. Whatever is the origin of the olive-oil, its fatty acids remain unaltered if the oil is pure. But if cotton-oil is present, the silver is reduced, and blackens the fatty acids which rise to the surface. In this manner, one per cent of cotton-oil can be detected in olive-oil. — *Moniteur Scientifique.*

INDUSTRIAL MEMORANDA.

A LONG RUN. — A ten-horse power Westinghouse engine has been running in the works of the Pittsburgh Gaslight Company for thirteen months without the throttle valve being shut, and it is still running. The engine has run continuously at about five hundred revolutions per minute, and has made two hundred and eighty-eight million revolutions in that time.

STEAM-HAMMERS. — The heaviest hammers constructed in Europe are chronologically enumerated as follows: Krupp, Essen, 1867, 40 tons; Terni Works, Italy, 1873, 50 tons; Alexandrowski, Russia, 1874, 50 tons; Creusot, France, 1877, 80 tons; Cockerill, Belgium, 1885, 100 tons; Krupp, Essen, 1886, 150 tons, — the latter now being the heaviest hammer in the world.

A NEW INDUSTRY. — A new branch of industry, according to *Iron*, is going to revolutionize the lace trade. A New York dealer in laces is exhibiting a specimen of lace of an extremely delicate pattern, and so light that it can almost be blown away by a breath of air. This lace is made of steel rolled as fine as the point of a cambric needle. It is not woven, but stamped out of a sheet of low-grade steel, so that it should not be too brittle. It was turned out of a small Pittsburgh mill, and sent to the dealer to show what could be done in that line. In the course of time other patterns will be made, heavier, perhaps, but certainly more tenacious than this piece. There is said to be no question as to its durability, and its cheapness would make it the most salable of all laces on the market. It may create a revolution in the lace market if rust can be guarded against.

RAILROAD NOTES.

THE first train to Bokhara, on the Transcaspian Railway, reached that city on the 10th of March.

THE locomotive boilers of the Pennsylvania Railroad are being fitted with inside valves, so that, in the event of the check-valve chambers being broken off, the inside valve will close, and prevent the escape of water and steam.

A STEAM-LOGGER, or snow locomotive, lately constructed, is in use in the logging camps of Northern Michigan, where it draws with ease sleds holding thirty thousand feet of logs over snow a foot deep.

GAUGE OF RAILROADS. — Of the total length of railroads in the world, about seventy-four per cent is of standard gauge (four feet eight and one-half inches), including the American differential gauge, twelve per cent of wider gauge, and fourteen per cent of smaller gauge.

A RAILROAD IN PALESTINE. — It is reported that the sleepers and rolling-stock for the line from Jaffa to Jerusalem, which will be constructed by a Belgian company, have already arrived on the spot. Probably much of the sentiment attaching to the Holy Land will disappear with the opening of the railway.

A SINGULAR ACCIDENT. — A passenger train was recently delayed for an hour near Morrow, O., from a singular cause. In some way the whistle-valve got open, and would not shut, and a constant screeching filled the air. An attempt was made to run the train with the whistle going, but too much steam escaped, and it was found necessary to stop until repairs could be made.

A PECULIAR "STEAL." — One of the telegraph lines on the Wabash road, known as No. 4, has been a source of mystery to the operators for some time. It had spasms of going and stopping, and the linemen have been unable to locate the trouble until quite recently. It was finally chased down to where an old man had led a wire into his house near Wabash, Ind., and was applying electricity for the cure of rheumatism.

A PERSIAN RAILROAD. — The construction of the first Persian railway has already begun. The line is to extend from Resht, on the southern shore of the Caspian, to Teheran. The distance, as the crow flies, is about a hundred and fifty miles; but, since the railway has to cross the Elburz range of mountains, it must have a much greater length than that. The work has been placed in the hands of a Belgian syndicate. The engineers are on the spot, and materials are arriving from Europe.

Home, Farm, and Garden.

CANNED GOODS.

The use of canned goods is now universal, and the empty tin can is found scattered over the entire country, from the summits of the Rocky Mountains to the sea-beaches of the Atlantic and Pacific coasts. It is said in the far West that the first article to enter a newly opened-up country is a barrel of whiskey, and the second a missionary; but even a Western cow-boy or prospector cannot live on whiskey alone, and the canned provisions form a convenient and cheap means of supplying the pioneers of civilization with food in regions where without them it would be almost impossible to travel.

The philosophy of preserving food from decomposition is very simple. After the cans are filled, they are heated to the boiling-point of water for a sufficient length of time to destroy all the microbes, or germs of decomposition and putrefaction which may be present. The can is then hermetically sealed, and, if the operation has been properly conducted, will preserve its contents indefinitely.

The question of the healthfulness of food preserved in this manner has been a subject of much discussion. It may become dangerous in two ways, — from a partial decomposition of the contents of the can, or a metallic contamination, from the tin or solder from which the can is made. Animal products particularly, in some stages of decomposition, are likely to develop certain exceedingly poisonous alkaloids, known as *ptomaïnes*. The well-known tyrotoxicon which is occasionally formed in milk and cheese, and causes serious illness, is an example of this class of bodies; and it is probable that the rare cases of illness reported from the use of canned meats are due to their presence. The danger from this cause, however, is so slight, that it may be practically considered as non-existent, as, with the modern improvements introduced into the canning process, and the care taken by reputable firms to secure fresh and wholesome materials, there is little likelihood of such accidents occurring. In addition, the slightest taint of decomposition is so very noticeable in canned materials, that it is hardly possible to overlook it.

There remains, then, the possibility of metallic contamination, and this is a matter of considerable importance. Of course, it could be entirely avoided by using glass or porcelain vessels; but the expense and fragility of these prevent their use in the majority of cases. The tin plates from which the metallic cans are made are formed from sheets of iron covered with pure tin. A cheaper grade, called *terne* plate, is covered with an alloy of tin and lead, and the solder with which they are joined together always contains a certain proportion of lead. Again: in the process of soldering, the metal must be cleaned with a corrosive liquid, and chloride of zinc is usually selected for the purpose. There is, of course, a possibility of contamination from any of these sources; but it is gratifying to know that it is a possibility that is rarely or never realized.

As far as we know, the cheap terne plate is never used for making the cans, and the action of the food upon metallic tin is not appreciable. Even if there should be any action, it must be remembered that the salts of tin, while unwholesome and injurious, are not nearly as poisonous as those of lead. As regards the use of solder containing lead, practical experience has shown that it is rarely acted upon in any way by the contents of the can. The principal canning firms now use a process by which the solder is applied on the outside of the can, so that little or none of it is brought in contact with the contents. As to the introduction of soldering fluid, it is always unnecessary, and could only happen through the most reckless carelessness.

In an article on this subject, the *American Grocer* makes the following statements: —

> So far as our knowledge and experience go, there is not a case on record of sickness or death arising from "poison accidentally introduced" during any process connected with the preparation of hermetically sealed food, nor has the report of a case showing the presence of any poisonous substance used in soldering been authenticated.
>
> Professor Edward S. Wood, M.D., who examined the canned vegetables for the Massachusetts State Board of Health, did not report a single case of any thing detrimental found in American canned goods; but, out of thirty-two samples of imported French vegetables, reported twenty-two showing the presence of copper used for coloring-purposes: but as regards this practice even such eminent French authorities as Pasteur sanction it as harmless, although American packers of vegetables do not use it at all.

While, therefore, we would not recommend the use of canned provisions when fresh ones can be obtained, we think the weight of testimony is very much in their favor as wholesome and harmless articles of food. In these, as in every thing else, there are different grades of quality and price; but the slightly greater cost of the goods prepared by well-known firms of undoubted reliability is more than counterbalanced by their assured purity and healthfulness.

ARTIFICIAL FLAVORS.

In the wonderful laboratory of the growing plant, by processes of which we know almost nothing, the atoms of carbon, hydrogen, oxygen, and nitrogen are made to group themselves into compounds which give to our vegetables and fruits the delicious flavors characteristic of them. In most cases this flavoring principle is so small in quantity, and so complex in its nature, that the chemist is unable to satisfactorily determine its composition; and it is probable that few of the natural flavors are simple chemical substances, but rather mixtures of different organic salts, ethers, and alcohols.

The flavoring principle of the majority of fruits can be directly extracted and preserved by simple means, forming extracts for flavoring food which are as unobjectionable as they are agreeable. Unfortunately it happens, however, that many of these flavors can be imitated by various chemicals, which, while they are much cheaper than the natural product, are unwholesome and even dangerous. As a general thing, the artificial flavors are much coarser and ranker than the natural ones, and lack entirely the peculiar fruity taste distinctive of the latter.

The greater part of the artificial essences belong to the class of compounds known as *ethers*, or, more strictly speaking, salts of an organic acid and base. The artificial essence pineapple, for instance, is composed of *ethyl butyrate*, or a combination of butyric acid (the acid of rancid butter) and a radical known as *ethyl* (C_2H_6), which is also present in common alcohol. By combining the ethyl with *pelargonic* acid, we obtain an ether with a flavor resembling that of the quince. *Ethyl caprate* is sometimes known as œnanthic ether, and is one of the flavoring substances found in old wine.

Another radical, *amyl* (C_5H_{12}), is also the base of several artificial flavors. Amyl alcohol C_5H_{11}–O–H is the poisonous fusel-oil found in the poorer grades of whiskey. *Amyl acetate* forms the well-known essence of Jargonelle pear, while *amyl valerianate* is a very good imitation of the flavoring matter of the apple. Amyl caprate is found in Hungarian wine.

The natural flavors of the peach, plum, almond, etc., are due to nitrogenous bodies containing cyanogen, the base of the poisonous prussic acid. With the exception of the almond, these flavors are not often imitated; but a substance made from coal-tar, known as *nitro-benzol*, has an intensely strong taste and odor of bitter almonds, and, under the name of oil of mirbane, is employed to a considerable extent as a perfume and flavoring extract. It is, however, a powerful poison, and should never be added to food.

Vanilla, as is well known, is the product of a Mexican plant. When pure it is perfectly wholesome, but it has been said to sometimes undergo a spontaneous decomposition which renders it dangerous. This, however, is not fully confirmed, and the bad effects observed may have been due to other causes. It contains a substance commonly known as *vanillin*, but chemists distinguish it by the brief appellation methylprotocatechuic aldehyde. This is now made artificially in large quantities from the gum of spruce and other coniferous trees.

There are many other organic bodies which possess very characteristic odors, although not commonly used for flavoring purposes. *Formate of ethyl* is sometimes used to give an agreeable taste to rum. *Acetic ether*, or acetate of ethyl, has the fragrance of cider, while *acet-acetic ether*, $C_2H(C_2H_3O)HO.O\,C_2H_5$, has the odor of new-mown hay. *Ethyl nitrite* has a pleasant apple-like smell; while *amyl nitrite* has an odor peculiar to itself, which produces such remarkable physiological effects, that it is

extensively used as a medicine. *Salicylate of methyl* occurs in the oil of wintergreen (checkerberry), and was one of the first vegetable products prepared artificially.

With the exception of nitro-benzol, all the artificial flavors mentioned above are composed of three elements only, — carbon, hydrogen, and oxygen. All the wide differences in odor, taste, and chemical behavior are due to slight variations in the proportions of these elements, and probably, also, to the position in which their atoms are arranged in the molecule. Strictly speaking, the only difference between the odorless glucose and the fragrant pine-apple oil is, that the latter contains four atoms less of oxygen; and the relation between the chemical composition and the physical properties of the organic bodies is a most important but still unsolved chemical problem. We may hope to know much more in the future, as many skilful and patient investigators are hard at work upon this very subject.

Although many of the above flavors are so strong that only a very small quantity is necessary to flavor a large amount of food, yet their use cannot be recommended. They are unwholesome, to say the least, and some are actually poisonous. Only natural fruit flavors should ever be allowed in the kitchen; and the cheap artificial essences should be left in their proper place, — on the shelves of the chemist's laboratory.

LAUNDRY SUGGESTIONS.

AMONG numerous suggestions for the laundry that come to mind, the following are jotted down: Perspiration stains in collars can be removed by using a very light bleach. For general laundry work, ten ounces of wheat-starch and six ounces of corn-starch to every gallon of water give excellent results. For the cold starch, wheat is the best material, especially for fine work, because corn-starch has a tendency to deposit blue, dust-like particles.

Gloss and stiffness can be produced on collars, cuffs, and shirt-bosoms by first putting them through a pretty stiff clear-boiled starch, and then drying them, after which they should be dampened with the following solution: One ounce of fine raw starch, one-quarter ounce of gum-arabic, one pint of water; heat the water to dissolve the gum, let it cool, and then stir in the starch, and add the white of one egg; beat the whole well together before using. Apply lightly with a sponge, and use a polishing iron to properly develop the gloss.

To keep flannels as much as possible from shrinking and felting, dissolve one ounce of potash in a bucket of water, and leave the fabric in it for twelve hours. Next warm the water, with the fabric in it, and wash without rubbing; also draw through the water repeatedly. Next immerse the flannel in another liquid containing one spoonful of wheat-flour to one pailful of water, and wash in a similar manner. Thus treated, the flannel becomes nice and clean, has barely shrunk, and is almost not at all felted.

The tendency of hot starch to adhere to the iron may be avoided by putting kerosene or spermaceti into it. A bit of white soap dissolved in the water used to prepare the cold starch each week will have the same effect.

A laundress of large experience writes that the doing of that most difficult thing of all in laundry work — the doing-up of shirt-bosoms — may be made highly successful by observing the following procedure: Enough cold starch to last several months may be made of one ounce of white laundry-wax, two ounces of borax, one teacupful of water, and three teacupfuls of starch. The borax and wax are dissolved in water sufficiently heated for the purpose, but not hot enough to scald the starch; into this mix the pulverized starch after passing it through a flour-sieve. In using, take a teaspoonful of this prepared starch, and dissolve in water that is not cold enough to prevent the wax from softening.

The hot starch is made, not very thick, and a teaspoonful is allowed to a shirt-bosom: the hotter the liquid is, the better. Apply a tablespoonful at a time, rubbing in well before putting on more; and after the right side will take up no more, apply to the under side. Unless the starch is well rubbed in, the iron will stick, and specks and blisters will appear. The hot starching is done first, the bosom is allowed to dry, and then the cold starching is done by dipping the bosoms in the liquid, wringing out, and rubbing slightly. After an hour or so, iron, first rubbing the bosom carefully with a cloth wrung out in hot water, to equalize the starch on the surface.

A thin cloth is to be laid over the bosom the first time the iron is passed over it. When this is removed, dampen the surface of the bosom a little, and finally iron carefully until the finish is satisfactory. Let the outside cover of the ironing-board be woollen cloth, and the bosom will not stick to it. — *Good Housekeeping.*

YANKEE VERSUS EUROPEAN COOKERY.

DR. WILLIAM C. PRINCE sums up his experiences as a traveller at home and abroad, in regard to food and cooking, that the reported excellence of English and European inns as a whole is all moonshine, and that, after Arab cooks, the best in the world are the farmers' wives of New England. Mrs. Blank, who cooks the meals for her family of four strong sons and two healthy, hearty daughters, to condense what Dr. Prince says, cannot make a partridge-pie out of veal and chicken-bones, but she can broil and serve the partridges as they were never broiled by the Frenchman, and give you a veal or chicken pot-pie which, unless your taste has been vitiated by so-called French cooking, will satisfy your highest gastronomic desires. America surpasses all parts of the world in the abundance and excellence of its meats, fish, game, vegetables, and fruits, says Dr. Prince; and he defies mention of any country in the world where the native population, from house to house, have as good cooking.

The notion that France is a land where good cooking prevails, Dr. Prince ridicules. Without discussing the merits or demerits of Parisian tables, he says that the provincial towns and villages and the little wayside inns of France are in darkness worse than heathenish on the subject of cooking food. Furthermore, he says that America, in the matter of inns, is the cleanest country in the world. The inns here are, on the average, much superior to European inns, either British or Continental. He asserts that the literature of the last fifty years has a great sin to answer for in the romance which writers have attached to country inns in England and some parts of the Continent. The ideal "old-fashioned inn" of the books is a humbug. It has not existed, as a general institution, within the past fifty years, and probably never existed. — *Good Housekeeping.*

BAD Drainage has killed more pot-plants than growers have perhaps ever suspected.

GLEANINGS.

GREENHOUSE STRAWBERRIES take about six weeks to fully ripen. A peculiarity of hothouse ripening is, that, instead of ripening first at the stem, gradually extending to the point, as is the case in the field berry, the greenhouse berry ripens at the point first.

HOW TO SEND FLOWERS BY MAIL. — Directions for safe packing are given in the *Horticultural Times*. A cardboard box about seven inches long by four and a half broad, such as shopkeepers have for crochet cotton, is the convenient size; and though at first sight it may appear too small to contain more than a dozen blooms, it is wonderful how much can be put in with judicious packing. In the bottom of the box lay a little slightly damp moss, then a layer of flowers and a few green leaves, another layer of flowers, and then finish with an upper stratum of moss. Pansies and lilies of the valley travel well, and will come out as fresh after a day's journey, and in almost as good a condition, as when first packed. If a difficulty occurs as to the length, the stalk should always be cut, as the bloom will not stand bending. Geranium blooms are too lightly set in the calyx to travel well; but primroses, violets, anemones, sweet peas, verbenas, tulips, mignonette, rosebuds, and forget-me-nots are all treasures to use for this purpose. After unpacking a box of flowers, place the tips of their stalks in boiling water, let them remain for about five minutes, remove them, cut off a tip from each stalk, and put in clear, cold water. Treated in this way, the most faded flowers will generally revive.

ANY soil upon which water does not remain during winter can be made to grow small fruits: in fact, any soil which will produce weeds will grow them; but as there are few soils which can produce two crops at the same time, it is better not to try to grow a crop of weeds and a crop of strawberries on the same soil together.

HONEY FROM APPLE-BLOSSOMS. — Professor Cook says, in the *New York Tribune*, that but few kinds of honey are superior to this. The color is light amber; and, though not quite equal in appearance to that from clover or basswood, it is not so dark as to be objectionable. The flavor is very characteristic, and reminds one of quince preserves. He has had it sampled many times, and no one has ever expressed any thing but admiration of its quality. The fact that so early in the season there are very few bees in the hives, as there are yet but few pleasant working-days, accounts for the fact that we usually get very little honey from the fruit-blossoms.

HOME-MADE OTTAR OF ROSES. — A correspondent of the *Horticultural Times* writes: "I took it into my head a short time ago that my roses might be put to some good use. I had a tin can made. The lid is air-tight, and has in the top a long tin tube of about an eighth of an inch in diameter, which is so bent as to allow of placing the end in a glass jar, at some distance from the can. The can is then filled with fresh roses, picked early in the morning, when the dew is on them, and the water poured in. The can is then placed on a stove, and the water made to boil for about an hour, the end of the tin tube being in a jar of water on a table near by; cold water passing about the jar continually, to prevent the steam from over-heating the water, and causing evaporation. The result is the raising to the top of the water in the jar the pure ottar of roses, which we purchase at so much cost. This is a simple contrivance, and can be operated without expense where there is a family of children to pick the roses and keep up a reasonable fire, too much heat not being desirable, on account of over-heating the water in the jar."

The Popular Science News.

BOSTON, JUNE 1, 1888.

AUSTIN P. NICHOLS, S.B. . . . . *Editor*
WILLIAM J. ROLFE, LITT.D. . . . . *Associate Editor*

Subscribers who are still in arrears for the present year will find a bill to January, 1889, enclosed in the present number. A prompt return with the necessary amount will be greatly appreciated by the publishers. Such small amounts are very likely to be overlooked, but the low price of the paper renders it all the more important that they should be promptly paid. Please remit by check, money order, or registered letter.

THE treasurer of the Illinois State Board of Health has communicated to us some facts which fully explain their recent action in revoking the license of a physician who advertised his practice in the newspapers, which was referred to in the May number of this journal (p. 73). It appears that the action was not taken on account of the advertising, but because of *fraudulent* advertising; the alleged physician claiming to cure incurable diseases, and, by the aid of hired representatives personating him, carrying on his business in several places at the same time. He certainly seems to have been a most unworthy member of the medical profession, and was undoubtedly entitled to very little consideration at the hands of the authorities. It is an additional illustration of the worthless character of the numerous advertising doctors who infest the country, and no one with any regard for his health or purse should pay any attention to their bombastic misrepresentations in the columns of the papers.

A COMPOUND extensively advertised under the name of "Scotch Oats Essence" has been a subject of much discussion in the medical journals lately. The proprietors modestly claim that it is a sure cure for the alcohol and opium habits, as well as innumerable diseases of every description. It is evidently prepared on homœopathic principles, as Dr. Francis Wyatt found a sample to contain over sixty per cent of alcohol, while other chemists have found notable quantities of morphine to be present in it. It would seem as if any person of average intelligence could detect the absurdity and falsity of the statements made in the advertisements of the innumerable patent medicines; but every new cure-all finds a ready market, and the crop of more or less genuine "certificates" to their efficacy is an unfailing one.

THE latest calculations of Professor Cooke and Mr. Richards give for the atomic weight of oxygen the number 15.869, which is considerably lower than the result first obtained. A constant source of error in the determinations was discovered, due to the change in volume of the glass globe in which the gas was first weighed, by the pressure of the air. Professor Cooke is inclined to think that there may still be some undiscovered source of constant error in the determinations which may alter the atomic weight still farther, but at present there is no way to discover it, and the weight given above must be considered the nearest approach to the true weight that has as yet been determined.

DR. C. H. YARROW of the National Museum has been carrying on a course of experiments (described at length in *Forest and Stream*) in an endeavor to discover an antidote for serpent venom. He believes that this has been found in the fluid extract of jaborandi, already used to some extent in medicine. It is to be hoped that the results of his experiments may be confirmed, and that a safe and effective cure for the bites of these dreaded reptiles has really been discovered.

MR. ÉMILE BERLINER recently exhibited to the Franklin Institute an improved form of phonograph invented by him, and named the gramophone. This instrument reproduces words loudly enough to be heard over a large room, while the phonograph emits only a very feeble sound. If the improvement is found to to be a practical one, it will add greatly to the value and usefulness of the original instrument, and still further adapt it to general use.

Two European chemists, Spring and Van't Hoff, have investigated the chemical changes produced by increased pressure. Finely pulverized copper-calcium acetate at a temperature of 104° F. was subjected to the action of a screw-press. The results were marked, three-quarters of the mass being liquefied, and becoming solid again when the pressure was removed. The sides of the containing vessel were covered with a coating of copper, and small leaves of copper could be picked out of the mass. The dark blue of the acetate had changed to green, interspersed with white points, indicating the separation into copper acetate and calcium acetate. Since the thermic effect of the compression was less than corresponds to a rise of 1°, the above result must have been due entirely to a change of volume. At ordinary temperatures a pressure of ninety thousand pounds produced no change except a consolidation of the powder into a crystalline mass.

SOME experiments recently performed by Grunewald and Meyer seem to show that the formula of ferric chloride should be written $FeCl_3$, instead of Fe_2Cl_6, as at present.

THE Cunard steamer "Etruria" recently made the passage from Queenstown to New York in five days and twenty-three hours, thus beating all previous records. Faster and more powerful boats are being built every year, and it is hard to say when the limit of speed will be reached. We have failed, however, to notice any attempt on the part of the various companies to make the voyage less disagreeable to the passengers by making their boats more comfortable, and supplying the conveniences and luxuries of travel which are so conspicuous on the Atlantic steamers by their absence. We doubt if these improvements will be introduced until there is a line of steamers to Europe which shall be owned and managed by an American company.

MR. H. C. BOLTON, University Club, New York City, is desirous of collecting words and expressions used in addressing domestic animals in all parts of the United States and in foreign lands. All correspondence will be gratefully received, and materials used will be credited to the contributors. A circular giving full particulars and instructions will be sent on application.

CRYSTALLIZATION.

As a general rule, most inorganic and many organic solid substances possess a certain typical form, which they tend to take when their molecules are temporarily enabled to group themselves in their natural positions. This, however, is impossible while they are in the solid state; and it is necessary to give freedom of movement by first liquefying the substance, either by melting, or dissolving in some liquid. Less frequently the solid may be changed by heating to the gaseous condition, and be deposited, on cooling, in the crystalline form.

If we dissolve a quantity of alum in water, and allow the solution to slowly evaporate, the alum will be deposited, not as a powder or in irregularly shaped masses, but in regular geometrical forms. In the case of alum the form is usually the octahedron, or a solid bounded by eight triangular surfaces, resembling two pyramids placed base to base. Common salt under the same conditions crystallizes in the form of a cube; while other substances, particularly minerals, take more complicated forms, which are still further varied by combinations of two or more forms upon the same crystal. A very good example of this occurs in crystals of alum, which are often a combination of the octahedron and cube; the planes of the cube appearing upon the corners of the crystal, and causing them to appear as if they had been cut off with a knife.

Crystallography is a science in itself, and is based upon intricate mathematical and geometrical principles. Without attempting to explain these principles, we may mention the six systems of crystallization to which all crystals may be referred.

It is evident that a solid must have three dimensions, or axes, about which its bounding surfaces may be grouped. In the regular or *monometric* system of crystallization, these axes are all of the same length, and placed at right angles to each other. A cube, for instance, has all its faces of equal size and all its angles equal to each other. A great many familiar substances crystallize in this system, such as salt, alum, diamond, garnet, and most metals.

In the *dimetric* system the axes are at right

angles to each other, but the length of one may be variable. In this system, instead of a cube, we should have a square prism of varying length. Comparatively few substances crystallize in this system, such as ferrocyanide of potassium and cassiterite (tin-ore).

In the *trimetric* system all the three axes of the crystal are of varying length, although still placed at right angles to each other. This system includes a large class of substances, among which may be mentioned nitrate of potash (saltpetre) and a great many minerals.

The *monoclinic* system comprises a very large number of substances, and is distinguished from the trimetric by having one of the axes inclined at a varying angle to the other two, which remain at a right angle to each other. Borax, sulphate of iron (copperas), carbonate of soda, and sulphate of soda (Glauber salts) are included in this system.

In the *triclinic* system, of which sulphate of copper (blue vitriol) is a good representative, all the axes are of unequal length, and are inclined to each other at varying angles.

The remaining system — the hexagonal, or *rhombohedral* — differs from the others in having four axes, three of which are equal, in the same plane, and inclined to each other at angles of 60°; while the fourth, or principal axis, is perpendicular to them all. The six-sided prism is one of the typical forms of this system, which comprises ice, quartz, carbonate of lime, and many other important substances.

As may be imagined, the number of geometrical forms which these different systems may give rise to is almost endless, especially as compound crystals, where one form is modified by another, are very common; but although the crystals of the same substance may differ in appearance, the systems are always distinct. Crystals of alum, for instance, which belong to the regular system, may be modified by the cube or other forms of the same system, but never by those of any other system. It is true that a few substances, like sulphur and carbonate of lime, crystallize under different conditions in two different systems; but the form of any given crystal is always true to its particular system, and no mixed forms have ever been observed.

The crystalline nature of different substances varies greatly. Iodine, for instance, always occurs in the crystalline form; while silica cannot be artificially crystallized at all, though the beautiful crystals of quartz show that in Nature's laboratory it has been done on a large scale. Bismuth readily crystallizes when melted, and allowed to cool slowly, while crystals of gold are rarely seen. Many salts, when crystallized from a solution in water, take up a certain amount, which is known as *water of crystallization*, and appears to form a part of the structure of the molecule. It can be driven off by heat, causing the crystal to crumble into powder, but not otherwise changing the nature of the substance. Carbonate of soda, for instance, when crystallized, contains ten molecules of water, amounting to about sixty-three per cent of its weight, a large part of which is given off by exposure to the air at ordinary temperatures.

What the meaning of the crystalline form is, or its relation to the chemical composition, is as yet unknown. Compounds chemically allied to each other generally crystallize in the same system, although there are exceptions to this. The crystal may be an indication of the actual shape of the molecule, or it may only be the result of the equilibrium of forces developed in that molecule. Whatever may be the cause of the beautiful geometrical forms which all unorganized matter tends to shape itself into, it is a widespread and universal force which shows itself in the delicate hoar-frost, as well as in the rocks of the mighty mountain-chain. Certain geologists have even tried to prove that our earth itself, as it cooled and solidified, tended to take the form of a gigantic crystal; and it is not impossible that we may yet pass the line between organized and unorganized matter, and find that the forces which give to the alum or salt crystal its characteristic shape are the same as confer symmetry and beauty upon the growing plant and animal. Of course, this is only speculation; but no one can say how soon it may not be a recognized scientific fact.

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[Special correspondence of the *Popular Science News.*]

BERLIN LETTER.

HERR W. MEISSEL, second officer of the North German Lloyd steamer "Werra," has devised a means of calming the sea by the use of oil, from on board a vessel, over a greater distance than has hitherto been possible. He employs rockets filled with oil, which are shot off in such a way that the oil itself is made to fall like rain on the troubled waters, and smooth a path for the vessel. The rocket consists of an oil-cylinder of tin, together with a chamber filled with gunpowder. Experiments with the invention have been very satisfactory, demonstrating the practicability of calming a surface from fifteen hundred to two thousand square feet in extent. The inventor intends to extend his idea, and prepare oil-bombs on the same principle.

THE balloon department of the Prussian army has adopted an invention which promises to facilitate aerial reconnoitring. Lieut. Richter, an ex-artillery officer, and Dr. Majert, a young chemist, have hit upon a method of producing inflating-gas on the spot where it is required, whether in the heart of an enemy's territory or on board a man-of-war. The apparatus for developing the gas resembles somewhat in appearance a traction engine or a threshing-machine, is drawn by six horses, and warranted to go wherever a field-gun can find access. The lower part is a furnace, adapted for any kind of fuel, especially wood, which is so easily obtainable almost anywhere; and above this are several parallel layers of retorts, about thirty in number, into which are thrust cases or cartridges filled with a mixture of zinc-dust and hydrate of lime. From this mixture is developed, by the action of heat, the hydrogen gas required by the balloon. About two hours are needed for producing a sufficient quantity of the gas. The authors of this system maintain its superiority to all others in cheapness, facility, and safety. The cases of compressed gas used by England and other countries are liable to explode while being transported from place to place, while the gas itself has frequently proved fatal to those handling it. The experiments conducted at Fürstenwalde, about an hour's ride by rail from Berlin, were witnessed by the invited representatives of the principal European powers (France and Russia excepted), and proved so satisfactory that the Prussian War Department adopted the invention.

TRIALS have recently been made near Potsdam, by the War Department, with magnesium light for signal-purposes, and the use of this substance for the so-called lightning-flashes on lighthouses was found expedient. The experiments were conducted partly on level ground, partly on the North Tower, situated on the Pfingstberg; and they all showed the remarkable range of the light. Both the flashes on the tower and those on the level ground, as well as the rockets, which ascended some thousand feet, were distinctly visible from all the fixed points of observation; e.g., from Brandenburg, Belzig, Spandau, Charlottenburg, and Berlin, — distances of thirty and thirty-five miles.

AN ingenious resident of Berlin, Capt. Plessner, whose *antiphon*, by the way, has freed so many sensitive nerves from the torture of inharmonious music, has now taken pity on the stairs-climber, and produced a cheap and simple elevator for domestic purposes. It is on the principle of the inclined railway, and the motive-power is furnished by the city water, which is applied in the cellar. Each flight is to have its separate chair; so that, for example, A can ascend from the first to the second story while B is on his way from the second to the third, or C is descending from the fifth to the fourth. The chair, being only of the width of the human body, takes up but little room, and leaves a free passage for those who prefer to walk up rather than ride. It is set in motion by a simple pressure upon one of its arms, while after it has been used it slides back to the bottom step, its descent being so regulated that it can carry a passenger with complete safety. The invention may be more curious than practical, but it is at least ingenious. The motive-power is more or less expensive according to the price of water. In Berlin the chair may be used at an expense of a little over one-tenth of a cent for each trip; the power, of course, remaining unused when the chair is at rest.

A HANOVER physicist, Dr. Kayser, has succeeded in obtaining a photograph of the aurora borealis from the summit of Mount Rigi in Switzerland. This is of interest because it has hitherto been held impossible to photograph the aurora, no plate being sensitive enough to be impressed by its rays. The well-known manual of physical geography by Günther (Stuttgart, 1885) distinctly states that it is "utterly impossible to photograph the aurora: the most carefully prepared plate remains neutral when exposed to its rays." Dr. Kayser made use of especial precautions, and employed a colored dry plate, the so-called *azalin-trockenplatte*.

MEDICAL papers bring news of the discovery of the cause of that disease which is feared only less than consumption, — the *cerebro-spinal meningitis*. In this age of Pasteur and bacteria we are prepared to learn that one of these contagion-bearing germs is responsible for the disease, and it has received the appropriate name *meningococcus*. Its activity consists in the inflammation of the envelop of the spinal marrow and of the brain, and it is identical with the cause of the inflammation of the lungs, which latter disease so frequently accompanies the

cerebro-spinal meningitis. The attempt has been made, in accordance with Pasteur's methods, to inoculate animals with the *meningococcus*, and the results have been satisfactory, though still further experiments are necessary before the inoculation can be practised safely on human patients.

Another discovery of interest is a new fever-cure, *phenacetin*, or phenic acid, which is said to be far superior to its immediate predecessors, antipyrin and antifebrin. It is prepared from petroleum, and appears in the form of a gray-red, finely crystallized mass, while its lack of taste and smell makes it a pleasant medicine. Professors Kast and Hinsberg in Freiburg first discovered the value of phenacetin as a fever-cure, and upon their recommendation the clinical professor Von Bamberger in Vienna first put it to practical use, and with excellent success. In doses of one-tenth to one-fifth of a gram for children, and one-half to one gram for adults, it quickly reduces the temperature, and effects the cure of the patient. The chief value of this over other similar medicines is its harmless effect upon the system. It is found effective also in cases of rheumatism and inflammation of the joints, as well as in headache and neuralgia.

P. F. B.

Berlin, *May* 25, 1888.

[Specially reported for the *Popular Science News* from the Observatory of the College of New Jersey.]

ASTRONOMICAL PHENOMENA FOR JULY, 1888.

There will be two eclipses during the month. The first, on the morning of July 9, a partial eclipse of the Sun, will not be visible in the United States. The region eclipsed lies in the Indian and Antarctic Oceans, between South Africa and Australia. The second is a total eclipse of the Moon on the night of July 22, and is visible throughout North and South America, and portions of Europe, Africa, and the Pacific Ocean. The phases of the eclipse in Eastern standard time are as follows: —

Moon enters penumbra	9h. 55m. P.M.
Moon enters shadow	10h. 55m. P.M.
Total eclipse begins	11h. 54m. P.M.
Middle of eclipse	12h. 45m. A.M. 23d.
Total eclipse ends	1h. 36m. A.M. 23d.
Moon leaves shadow	2h. 35m. A.M. 23d.
Moon leaves penumbra	3h. 34m. A.M. 23d.

The Planets. — Mercury passes inferior conjunction, and becomes a morning star, on July 8. On the morning of July 29 it reaches its greatest western elongation, not quite 20° from the Sun, and may be seen during the early morning twilight low down in the eastern horizon for a few days at the close of the month. Venus passes superior conjunction on July 11, and becomes an evening star, but remains too near the Sun to be seen during the month. Mars is still to be seen in the western sky in the evening, but is growing fainter. It is in quadrature with the Sun on July 22. At the beginning of the month it is a little north of Spica (*Alpha* Virginis), and moves east and south during the month. Jupiter is on the meridian about 9 P.M. on July 1, and at about 7 P.M. on July 31. It is nearly stationary during the month, and is about 5° west of the second-magnitude star *Beta* Scorpii.

The following eclipses of Jupiter's satellites are visible in the United States during the month. The phenomena all take place near the planet, on the upper right-hand quadrant, as seen in an inverting telescope. R. denotes reappearance. Times are Eastern standard.

I. R. July 1, 10h. 24m. P.M.	I. R. July 17, 8h. 42m. P.M.
II. R. July 8, 8h. 34m. P.M.	I. R. July 24, 10h. 36m. P.M.
I. R. July 9, 12h. 18m. A.M.	III. R. July 31, 7h. 58m. P.M.
II. R. July 15, 11h. 12m. P.M.	

Saturn is rapidly approaching the Sun, and can be seen only during the early part of the month, soon after sunset. Uranus is in quadrature on July 4. It is in the constellation Virgo, about 9° west and north of Spica. Neptune is a morning star, south of the Pleiades, rising about three hours before the Sun.

The Constellations. — The positions given hold good for latitudes differing not many degrees from 40° north, and for 10 P.M. on July 1, 9 P.M. on July 16, and 8 P.M. on July 31. On the southern meridian are Corona Borealis near the zenith, and Scorpius with Jupiter low down near the horizon. Sagittarius is just rising in the south-east. Hercules is east of the zenith. Aquila is about halfway up, a little south of east. Lyra is a little north of east, somewhat higher than Aquila, and Cygnus is below Lyra. Delphinus is near the eastern horizon. Draco lies on both sides of the meridian, between the zenith and pole. Cepheus is to the right of the pole star; Cassiopeia near the horizon, a little east of the meridian. The principal stars of Ursa Minor lie near the meridian above the pole. Ursa Major is to the left, with the pointers at about the same altitude as the pole star. Bootes is just west of the zenith, and Leo is near the western horizon; Virgo, with Mars and Uranus, follows Leo low down in the south-west; and Libra lies between Virgo and Scorpius.

Princeton, *June* 1, 1888.

[Specially reported for the *Popular Science News*.]

METEOROLOGY FOR MAY, 1888, WITH THAT OF THE SPRING.

TEMPERATURE.

Average Thermometer.	Lowest.	Highest.	Range.
At 7 A.M.	51.32°	37°	66°	29°
At 2 P.M.	63.39°	44°	80°	36°
At 9 P.M.	53.55°	40°	73°	33°
Whole month	56.09°	37°	80°	43°
Last eighteen Mays	57.36°	51.34°, in 1882.	64.28°, in 1850.	12.94°
Spring of 1888	43.51°	13°	80°	67°
Last eighteen springs	44.84°	42.15°, in 1875.	49.09°, in 1878.	6.94°

The first three days of the month were the coolest, with an average of 44⅔°; the 2d being only 40½°. The last three, with the 10th, were the four warmest, with an average of 69⅔°; the 30th was extreme at 71½°. The lowest point reached was 37°, on the 2d, and the highest 80°, on the 10th, 29th, and 30th. The entire month was nearly 1½° below the average of May in eighteen years, and the coolest, with two exceptions (1882 and 1885). As the last April was also the coolest April in eighteen years, we are not surprised to find the entire spring below the average, and consequently the season a full week behind the usual, and three weeks behind that of 1886, while the spring of 1882 was several days still later than the present. My comparison in this estimate is chiefly founded on the dates, noted from year to year, when certain trees and bushes blossom, observed more especially for the last ten years.

SKY.

The face of the sky in 93 observations gave 27 fair, 14 cloudy, 40 overcast, 11 rainy, and 1 snowy, — a percentage of only 29 fair, the lowest of any month in the year for eighteen years. Only six times in this period has any month fallen below 40 per cent, and these chiefly in March and April. This great cloudiness the past month has doubtless tended to increase the lateness of the spring. From the 24th to the 29th was almost constant cloudiness, with cool easterly winds, threatening rain, a nearly stationary barometer, — a disagreeable spell, followed, however, by a few warm days of growing-weather. The average per cent fair for May in eighteen years has been 54 8, with the wide extremes of 29, in 1888, and 78.5, in 1871. The average per cent fair the last eighteen springs has been 52.1, while that of the present has been only 47 2.

PRECIPITATION.

The amount of rainfall the past month, including the trace of snow, was 3 95 inches, while the average for the last twenty Mays has been only 2 91, with extremes of .55, in 1878, and 4.60, in 1882. The rain the past month has generally been in small quantities, but very frequent. The largest amounts fell on the 12th and 15th, both amounting to 2¼ inches. The amount since Jan. 1 has been 26.80 inches, while the average of this period in twenty years has been only 21.84. The amount the present spring has been 15.37 inches, while the average of the last twenty springs has been only 12.15.

PRESSURE.

The average pressure the past month was 29.99 inches, with extremes of 29.78, on the 1st, and 30.20, on the 4th, 8th, and 22d, — a range of .42 inch; showing unusually high and uniform pressure for May. The average pressure for the last fifteen Mays has been 29.944 inches, with extremes of 29.868, in 1874, and 30 038, in 1887. The sum of the daily variations was 2.66 inches, giving an average daily movement of .086; while this average in the last fifteen Mays has been .123 inch, with extremes of .073 and .170. As the warm season approaches, the barometric changes diminish. The largest daily movements were only .27, on the 2d and 12th, .22, on the 1st, and .19, on the 9th, all in near connection with rainfall. The pressure the last spring was 29.996 inches, and the average of the last fifteen springs 29.906. The average daily movement the last spring was .166 inch; the last fifteen springs .178.

WINDS.

The direction of the wind in 93 observations gave 15 N., 4 S., 9 E., 13 W., 16 N.E., 11 N.W., 6 S.E., and 19 S.W., an excess of 13 northerly and 12 westerly over the southerly and easterly, indicating the approximate average direction to have been W. 47° 17′ N., or nearly N.W. The westerly winds have uniformly prevailed over the easterly, with one exception (3 E., in 1881), by an average of 22.68 observations, and the northerly over the southerly, with six exceptions, by an average of 2 95; indicating the general average direction in nineteen Mays to have been W. 7° 24′ N. The relative progressive distance travelled by the wind the past month was 17.69 units, and during the last nineteen Mays 434 6 such units, — an average of 22.35; showing greater opposing winds the past May than usual. The average direction the last spring was W. 38° 44′ N., while that of the last nineteen springs has been W. 28 51′ N. The average distance travelled the last spring was 135 9 units, and the average for the last nineteen springs only 100.2 units, showing less opposition than usual the last spring.

D. W.

Natick, *June* 5, 1888.

Compressed Air in Paris. — The canalization for the distribution of this power to small factories, etc., has reached a length of fifty kilometers. The engines at the central station have three thousand horse-power, and a pressure of six kilograms is given to the customers. The consumption of coal is fifty tons a day, and ninety-five thousand cubic meters of air are compressed daily.

Correspondence.

Brief communications upon subjects of scientific interest will be welcomed from any quarter. The editors do not necessarily indorse all views and statements presented by their correspondents.

"HOW BIRDS LEARN TO SING"

was a proposition disposed of, in your May issue, by the answer, "*imitation.*" That many birds do imitate, and have learned notes that do not belong to their class or species, I admit; but it is an axiom in natural history that each species is discernable by their form, color, and note, and a still more apparent truth that eccentric notes have never been known to have been transmitted by any particular species to its rearing young.

Eight or ten phenomenal cases never prove the rule, no more than meteoric stars establish the course of the planets.

On Washington Street, near Summer, a lovely canary may be found who whistles "Yankee Doodle" complete, just as he was taught by his patient mistress. Other canaries who had the same opportunity, failed to learn this specialty, while all sing the uniform song of the canary.

"*Young birds will never sing the song* PECULIAR *to their tribe if they have never heard it*" is a bold assertion of your correspondent, in which he establishes, by admission, that birds have a "*song peculiar to their tribe.*" If that is admitted, then some birds must have *minds* or *instincts.* If minds, then, as a mental effort, they select the song of those of like feather designedly, to keep up the family relation. If not, then it must be by instinct. Let us see what is the prevailing trait. Every lady who raises canaries — and there are thousands — will tell you that, as soon as the female is mated, she is removed from the male. The songless mother hatches her young, and ushers the little birdlings into song-life self-dependent. In a majority of instances the young are brought up entirely apart from any singer. Soon their musical characteristics are developed, and instinct comes to their aid with the "*song their fathers sang.*"

Nearly fifty years ago I assisted in raising a nest each of robins, brown thrashers, yellow-birds, and bobolinks. All came to be singers. Some were shorter-lived than others. No one of them ever had "*the opportunity of hearing the song peculiar to their species.*"

In a few months, amid the busy hum of active business-life, they began to sing. The robin was first, and his notes were exactly like the "*noble John*" who welcomes the gray dawn in the grand old elm near my dwelling. The thrashers were slower in time; but from the pianissimo rendered at rehearsal, while hammering a nut in the bottom of the cage, they daily grew into the fortissimo, rolling forth their notes, and vieing in originality with their polyglot brothers who honor the sunny South, having a more extensive name, but no better song.

The same was true of the yellow-birds and bobolinks distinctive species notes, — instinctively rendered while surrounded by other songsters, — singing thus instinctive, and yet purloining not a note from those about them.

Birds, as a class, are not imitators, but instinctive originators. Were it not so, the notes of the robin, wren, blue-bird, yellow-bird, black-bird, oriole, and sparrow, all of whom abide within a stone's throw of my dwelling, would, in a mingled jargon, be so presented to the ears of the growing birdling as to produce a musical pandemonium, unendurable to themselves.

Where does the mocking-bird raised in the North, in a worse than orphan-asylum, away from all birds of even a kindred note, get his melodious chorals, if not from instinct?

Five pairs of muscles stretch or relax the vocal chords attached to the lower larynx, which constitute the organ of song, differing in each species. The robin *cannot* sing like the mocking-bird, nor like the canary or goldfinch; and yet by chance, as *some* do, they learn a note not instinctively their own. I knew of no record that declares that the offspring ever learned the alien notes of its father, forgetful of its species.

Birds sing by instinct; man is educated, as an act of the mental powers: so that there can be no similarity between a bird and a man, although both are taken to France in their youth, at the same age, when the bird sings the song of its species, like the ever-present canary, and the man learns only to talk French.

WM. CAHOONE GREENE.

BOSTON, *May* 20.

YOUR correspondent in the May number of the *Popular Science News* says: "Young birds will never sing the song peculiar to their tribe if they have never heard it," etc. Certainly a mistake. I have now in my office one of the best and most varied singers of the canary tribe. He is now nearly three years old, and I know to a certainty he never heard one of his tribe sing until he was two years old, and at that age he was about as noisy and varied a singer as I ever heard. I bought his mother when she was incubating, and took her far out in the country, away from nearly all kinds of birds. She never sang, merely chirped; but her son in the cage above me is a "clipper," and no mistake. Does your correspondent mean to say that a cockerel hatched in an incubator away in the woods will not crow, and in the absence of one of his tribe would quack like a duck if he had such a teacher?

DR. C. H. MERRICK.

DWAMISH, WASHINGTON TER.

QUESTIONS AND ANSWERS.

LETTERS of inquiry should enclose a two-cent stamp, as well as the name and address of the writer, which will not be published.

QUESTIONS regarding the treatment of diseases cannot be answered in this column.

O. R. R., *Massachusetts.* — Is the water purer in an open well than in one that is closed? and is it a benefit to water to be agitated in the air, so that it may absorb some of it?

Answer. — Wells should be ventilated, as the water is thereby kept fresh and free from bad odor. The absorption of air by water renders it pleasanter to the taste, and purifies it to some extent; but the effect is not a very marked one.

INQUIRER. — Why will dynamite explode by percussion, and not by contact with flame?

Answer. — The philosophy of the explosion of dynamite and other nitro-glycerine compounds is not well understood; but it is supposed that the explosion of the fulminate which is used as an agent of percussion, causes the molecules of the nitro-glycerine to vibrate at such a rate as to cause an instantaneous decomposition throughout the mass. The principle is the same as when a musical note of a certain pitch causes a piano-string or bell tuned to the same pitch to vibrate in unison with it.

W. W., *Pennsylvania.* — Is iron-ore reduced to the metal simply by the heat of the blast-furnace, or is there some chemical change involved?

Answer. — Many people suppose that the iron is simply melted out of the ore, but this is a mistake. The ore is usually an oxide of iron, which, when heated with the carbon of the coal, gives up its oxygen, forming carbonic dioxide and metallic iron. The actual reactions taking place in the furnace are more complicated than this, which only represents the general principle of the process.

E. W. S., *Ohio.* — We do not consider galvanized iron to be a safe material for water-pipes. Zinc is a metal which is readily attacked and dissolved by certain waters, forming unwholesome and poisonous salts.

C., *St. Louis.* (1) Palladium is a somewhat rare metal resembling platinum. It cannot be magnetized, and has been used to some extent as a substitute for steel in watches which are likely to be exposed to magnetic influence. (2) Lithium is the lighest metal known. It has the specific gravity of 0.59. Aluminum is the lighest common metal, with a specific gravity of 2.67. (3) The diamond cannot be fused, but can readily be burned in an atmosphere of oxygen gas. The first recorded experiment of this sort was made by Lavoisier in 1772, although the fact was known before.

LITERARY NOTES.

The Fundamental Principles of Chemistry. By Robert Galloway. Published by Longmans, Green & Co., New York. Price $1.75.

The author in this work has made a new departure from the usual methods of teaching chemistry. Great attention is given to the practical and experimental sides of the science, and the theoretical portion is naturally and easily acquired as the student progresses in his work. The first part of the work is devoted to a course in physics, a science which is inseparably connected with that of pure chemistry. We thoroughly approve of the scheme of this work, and can recommend it to the attention of instructors.

The same firm has also issued Part II. of *The Old and New Astronomy*, by Professor Proctor. This part treats of the shape of the earth and the movements of the heavenly bodies. The parts already published show that the complete work will be a most valuable and important one; and, as it is issued in separate monthly parts, subscribers can obtain it without putting themselves to unusual expense.

Composition and Rhetoric. By William Williams, B.A. Published by D. C. Heath & Co., Boston.

This excellent work is designed for a text-book for schools. It is extremely practical, and proceeds on the method of laying down a few principles at a time, and then illustrating them with exercises, so that the pupil may master their practical application, and learn, not only to write, but to speak, correctly.

The same firm publish the *Nature Readers*, most delightful little books describing the habits of birds, insects, and other animals in a manner calculated to interest and entertain the youngest readers; and the *Old South Leaflets*, a series of essays on political subjects, equally valuable, but adapted to more advanced scholars.

Turning-Lathes. By James Lukin. E. & F. N. Spon, publishers, New York. Price $1.00.

The rapid growth of the system of manual training and trade schools, especially abroad, has led to the creation of a class of literature which now fully covers the methods of most of the trades. The present volume belongs to this class, and, in our judgment, will admirably meet the purpose for which it was intended. The several types of lathes, both for wood and metal turning, and their parts in detail, are fully described and illustrated, as also are the various operations of the latheman's art. Amateur turners will find in it many useful hints.

P. Blakiston, Son & Co. of Philadelphia have published a new edition of *Tanner's Memoranda of Poisons* (price 75 cents), which every physician will find a most useful book for reference. All known poisons and their mode of action are described, and the antidotes for each are given in full, and their manner of application thoroughly explained. In case of an unexpected emergency, it may be found to be of the greatest service.

The Woman's World is an interesting monthly magazine published by Cassell & Co. of New York at $3.50 a year, and particularly devoted to the interests of the feminine portion of humanity. The July number at hand contains many interesting articles by prominent lady writers, and the table of contents comprises a variety of subjects which will suit the most fastidious.

Pamphlets, etc, received: *World-English, a New Universal Language*, by A. Melville Bell (price 25 cents, of N. D. C. Hodges, 47 Lafayette Place, New York); *A Messenger of Light and Index to Gospel Truth*, by E. Miller, M.D., Kingston, Mo.; *The Journal of the College of Science of the Imperial University at Tokyo, Japan*; *Discovery of the Origin of the Name of America*, by Thomas de St. Bris; *Improvements in the Manufacture of Sulphuric Acid*, by F. W. Chappell; *Water and its Impurities*, by E. W. Moore, M.D., San Francisco; *An Indictment of Darwin*, by Oswald Dawson; and the *Annual Reports of the Hartford Retreat for the Insane* and *the Boston Washingtonian Home.*

Medicine and Pharmacy.

UREA.

An important product of the decomposition of the nitrogenous tissues and foods of the body is a substance known as urea, which is excreted in large quantities through the urine. It is a highly crystalline body, very soluble in water, and containing 46⅔ per cent of nitrogen. More than nine-tenths of all the nitrogen taken into the system is excreted in this form. It is supposed that the liver is the chief organ concerned in its formation. An adult excretes about five hundred grains of urea daily, although the amount varies considerably under different circumstances.

In certain diseases and conditions of the system, urea is formed in abnormally large quantity. The exact quantitative determination of the amount present is a matter of some difficulty, but an approximate test is easily made by adding to a sample of the urine an equal amount of pure, strong nitric acid. This should be done in a test-tube which is kept cool by being placed in a vessel of cold water. If an excessive amount of urea is present, beautiful groups of tabular crystals of nitrate of urea will separate out in the course of ten or twenty minutes. These crystals will not develop in normal urine unless it has been previously concentrated by evaporation.

From a chemical point of view urea is a substance of the greatest interest and importance. Its chemical name is *carbamide*, and it has the symbol $CO(NH_2)_2$. It is best considered as a substituted ammonia formed from two molecules of ammonia $(NH_3)_2$ by replacing two atoms of hydrogen, one from each molecule of ammonia, by the dyad radical CO. The greatest point of interest about it, however, is, that it is the first organic substance ever made artificially from inorganic materials. It was formerly a favorite theory among chemists that the line between inorganic and organic bodies was impassable, and that the latter could only be formed through the agency of a living organism, either vegetable or animal. In 1828, however, the German chemist Wöhler discovered that by heating a solution of iso-cyanate of ammonia, a strictly inorganic salt, it was transformed into urea, which had hitherto been known only as a product of the animal organism. The iso-cyanate of ammonia is *isomeric* with urea; that is, it contains the same elements in the same proportions: so the great difference in the physical properties of the two bodies must be due to the different arrangement of the atoms which compose the molecule. A comparison of the so-called graphic symbols of the two substances will make this distinction clearer.

Iso-cyanate of ammonia. Urea.

$$O=C=N-N\overline{=}H_4, \quad O=C=\begin{matrix}N=H_2\\N=H_2\end{matrix}$$

The actual symbol (CON_2H_4) is the same in both cases, but the grouping of the elements is entirely different. It should also be observed, that, in the transformation to urea, one of the nitrogen atoms changes its quantivalence from three to five (see May number, p. 73). In later years a very large number of organic bodies have been made artificially.

Urea forms an immense number of compounds and derivatives which are only of interest to the chemist. The most important one physiologically is uric acid $(C_5H_4N_4O_3)$, which is present in small quantity in human urine, but is the chief ingredient of that of birds, reptiles, and insects. The excrement of birds contains a very large percentage of this acid in combination with ammonia, and the great value of this material as a fertilizer is due to the large percentage of nitrogen available for plant-food which it contains.

Hippuric acid $(C_9H_9NO_3)$ occurs in large quantity in the urine of horses and other herbivorous animals, but that of man and the carnivora only contains a trace.

Although urea is itself a product of decomposition, it is not very stable, and tends to break up still further into salts of ammonia, the odor of which is very perceptible in decomposing urine. It is interesting to trace in the imagination the transformations which an atom of nitrogen may undergo. As a constituent of ammonia it may be absorbed by the growing plant, and take its place in the complicated structure of some nutritive vegetable material; thence it passes into the body of a sheep or ox, and becomes a part of its gelatin or albumen. Then it may be appropriated by a member of the human family, giving strength to his muscles and vigor to his constitution. But having thus performed its part, it is changed by the mysterious vital processes into urea, which, breaking up into a still simpler substance, sets the nitrogen free in the form of ammonia, ready to be appropriated by another plant, and again pass through the same circle. These changes are no matter of fanciful speculation, but are actually occurring every day, and are a striking proof of the scientific axiom, that matter may change its form continually, but can never be destroyed.

THE RIND OF FRUIT INDIGESTIBLE.

That the rind, or "skin," of all fruit is more or less indigestible, is a fact that should not be forgotten. We say *all* fruit, and the statement must be understood to include the pellicle of kernels and nuts of all kinds. The edible part of fruit is peculiarly delicate, and liable to rapid decomposition if exposed to the atmosphere; it is, therefore, a wise provision of nature to place a strong and impervious coating over it, as a protection against accident, and to prevent insect enemies from destroying the seed within. The skin of plums is wonderfully strong compared with its thickness, and resists the action of water and many solvents in a remarkable manner. If not thoroughly masticated before taken into the stomach, this skin is rarely, if ever, dissolved by the gastric juice. In some cases pieces of it adhere to the coats of the stomach as wet paper clings to bodies, causing more or less disturbance or inconvenience. Raisins and dried currants are particularly troublesome in this way, and, if not chopped up before cooking, should be thoroughly chewed before swallowing. If a dried currant passes into the stomach whole, it is never digested at all.

In the feeding of domestic animals this fact should be kept in mind. If grain and leguminous seeds are not crushed or ground, much of the food is often swallowed whole, and the husk or pellicle resists the solvents of the stomach, causing a considerable loss of nutriment. Birds, being destitute of teeth, are provided with a special apparatus for grinding their seed; namely, the gizzard.

The indigestibility of certain nuts is partially due to the brown skins. Blanched almonds on this account are more digestible than those which have not been so treated.

[Original in *Popular Science News.*]

SOME FACTS CONCERNING BRIGHT'S DISEASE.

BY JOHN CROWELL, M D.

II.

The chronic form of Bright's disease presents three types, which may be summed up as, first, the smooth, white kidney; second, the granular, mottled kidney; third, the waxy or amyloid kidney. In the first form the structural change extends to the fibrous substance, in which the fatty degeneration is found, causing enlargement of the organs to double their natural size, and giving them a yellowish-white appearance. Hence the name, *smooth, white* kidney. In the granular form the kidneys are diminished in size and weight, and the texture is tough and unyielding. The urine is at first copious and of less specific gravity. As the disease advances, the quantity diminishes, the albuminous deposit is slight, and occasionally absent.

In the majority of cases the urine contains epithelium and granular casts, which are eliminated from the uniferous tubes. Out of two hundred and fifty cases of this form of the disease examined by Dickson, the average age of the patients was about fifty years. In the waxy form the kidney is usually enlarged. The true nature and source of this waxy material has never been definitely determined. Dickson supposed it to be a species of fibrine containing less alkali and a larger proportion of earthy salts. Virchow believed that it belonged to the same class of substances as salt and cellulose tissue, on account of its yielding a violet color when combined with sulphuric acid and iodine.

The albumen at first is slight, becoming quite profuse as the disease advances. The urine is pale, containing epithelium cells and fat corpuscles.

An interesting condition of the urine in this disease is noted by De Beauvais, who states that the odor imparted to healthy urine by the digestion of asparagus is wanting, and that the smell of violets, so familiar, which the renal secretion gives off in patients taking turpentine, as well as the smell of pepper from the taking of cubebs, are generally absent.

The immediate cause of death is variable. About one-third of the victims of the chronic form perish by uræmic poisoning, either in the form of coma and convulsions, or irrepressible diarrhœa and vomiting. Some die from the dangerous situation of the dropsical effusion, as when the glottis or the lungs are invaded. About one-fifth die of secondary pneumonia, pericarditis, or double pleurisy.

The great danger in this disease lies in the enervation of the organic nervous system. It is

invited in its common form from severe and long-continued mental strain, from whatever cause.

The cares of large business interests, financial reverses, political disappointments; the vain attempt to do too many things well; the wear and tear incident to continuous fast railroad travel, with loss of sleep, and irregular habits in the observance of the common functions of digestion, — these are either remotely or nearly connected with the incipient causes of the disease. To these may be added the mental strain brought to bear upon the literary man who writes under pressure, and whose hours of work extend far into the night.

Fast living and sensual indulgences, and the free use of alcoholic stimulants, form a part of the category of direct or indirect causes. Many a brilliant light has gone out because of the neglect to heed the warnings of nature or the advice of the medical attendant.

Whenever the digestive functions are overtaxed by irregular eating and drinking, the kidneys suffer in the elimination of the superabundance of the nitrogenous products of the food not required for the growth of the tissue, and which must be eliminated. The liver, being overtaxed from the excessive carbon and hydrogen of alcoholic drinks, becomes weakened in its functions; and the kidneys are called to take care, not only of the superabundant food, but also of the carbon and nitrogen that the liver was unable to manage. Hence the urinary secretion becomes impaired.

When we consider the counection between intense nervous strain and disease of the important organs and the system, can we wonder that the secreting structure refuses to do its duty under these morbid conditions, and that so many strong men succumb to the power of disease? When a man of fine physique and of good ancestry complains of being tired under the discharge of his chosen vocation, and when every thing he attempts seems a burden to him, we may suspect that the cause of the lassitude and turpitude may be lurking in a disordered secretion, whose seat is the urinary organs. Examination into the history of the case, and the urinary tests, too often reveal the secret, which, if not discovered too late, may be palliated, if not wholly dissipated. Such a man must curtail his business; he must curb his appetites; he must refrain from late suppers, and the fascinatious of club-rooms, ball-rooms, and theatres; he must be willing to take life soberly and sensibly, and submit to a *régime* simple, temperate, and oftentimes severe. The dozen cigars per day must come down to two; the fancy drinks and suppers must give way to abstemiousness; the merciless sway of the passions must be subdued; and the "thus far shalt thou go, and no farther" must be applied like the air-brakes to the lightning express. He must not go out of the range of the doctor's keen research, and he must be held accountable to him by a severe discipline; and his courage must be stimulated by the assurance of success if he does not yield. Many a man is saved by such oversight, and his life lengthened out for many years in the performance of useful if less exacting duties.

But shall there be no medication in this warfare with disease? Shall there be no diuretics? Certainly. They are valuable when used judiciously. Bennett, in his exhaustive *Clinical Practice*, reduces diuretics in this disease to the simple use of bitartrate of potass, which in his hands has proved most effective when all else had failed. He contends that diuretics thus used not only lessen dropsical accumulations, but also tend to wash out the obstructions to the malpighian bodies

Dr. Tanner would rely upon mild diaphoretics, gentle aperients, dry cupping over the loins, and tonics.

Dr. Seth Pancoast, in his valuable little monograph, deprecates much interference by medication, relying upon a general dietetic and sanitary discipline. Especially does he warn against the indiscriminate use of iron. It will not cure anæmia as long as the vital energy is so enervated that it cannot carry on a normal assimilation. Anæmia results from an impaired vitalization of the chyle in its passage through the mesenteric glands, and therefore the white corpuscles cannot advance to the red corpuscles or blood-disks. Iron, if given at all, should be given in very small doses, for an exceedingly small quantity only is needed for assimilation. But such are the limitations in the efficiency of drugs, in the management of this disease in its ordinary chronic manifestation, that the physician soon learns to rely mostly for guidance upon the general principles already indicated.

It is always fortunate if the patient seeks intelligent advice during the incipient stages of the insidious malady. Fortunate is he also if he is not captivated by some popular nostrum, which he uses under the charm of a latent but psychical force, whose virtues are set forth by the rhetoric so cheaply obtained, but costing so dearly.

How many simple, practical rules are obtainable! Protection from the vicissitudes of a changeable climate can be observed, for the least exposure to dampness will ofteutimes bring congestion to the kidneys. Freedom from care and mental depression is desirable and often obtainable. The diet should be nutritious and of a mixed character, avoiding condiments, but using animal food, especially in the earlier stages, when it becomes more easily assimilated.

With such care and watchfulness, and with implicit obedicuce, chronic Bright's disease is curable, even after the kidneys are seriously disorganized, provided that the inflammation has been removed, and the nervous energy re-established. The vital force, located in the system, calls for aid, and this aid must be offered by intelligeut and persistent oversight and obedience.

[Specially compiled for the *Popular Science News.*]

MONTHLY SUMMARY OF MEDICAL PROGRESS.

BY W. S. WELLS, M.D.

AT the late meeting of the Congress of the German Surgical Society, held in Berlin, Professor Bergman, president, in the chair, Herr Brieger made a demonstration of the action of three *Ptomaïnes*. He injected into a rabbit a solution of *tetanine* obtained from the amputated arm of a man suffering from tetanus (lock-jaw). In about five minutes the animal exhibited all the symptoms characteristic of traumatic tetanus, following injury in the human subject.

The second experiment was the injection of a solution of *neurine*, which caused first a flow of a thick fluid from the nose; then profuse salivation appeared; and later the animal suffered from difficult breathing, became paralyzed, and died in convulsions.

The third ptomaïne was *mytilotoxine*, obtained from diseased mussels. When given to a man suffering from tetanus, it caused a relaxation of the clonic spasms; but in animals it did not have the same effect. An animal poisoned with this toxine had head-drop difficult breathing, convulsions, and paralysis.

AT the late meeting of the American Medical Association, Dr. N. Senn of Milwaukee read a paper on, and demonstrated a new means of, diagnosticating penetrating wounds of the abdomen.

The existence of a wound in the bowel where there is extravasation into the peritoneal sac has always been considered fatal, unless laparotomy is performed. Punctured, penetrating wounds are less fatal than gunshot wounds. In order to determine some means of diagnosis, he had experimented to find some innocuous gas which could be injected, to distend the viscera until it made its escape through the wound.

The first experiment showed that hydrogen gas can be made to pass the entire length of the gastro-intestinal canal, from the anus to the mouth. Inflation through the mouth is only used to diagnose wouuds of the stomach, as the gas does not easily pass the pylorus. Hydrogen gas is perfectly innocuous and unirritating, and is rapidly absorbed when injected into any serous cavity or into the connective tissue. All that is necessary in using the gas is a rubber balloon holding sixteen liters. Inject gradually. The method locates the number and location of wounds. Enemata of the gas were given to dogs for a few minutes, and it was then ignited at the animal's nose. A stab-wound was then inflicted, and the gas ignited at the point of puncture. In like manner, a pistol-shot wound was diagnosticated.

In wounds of the bowel this method is of special value, avoiding aggravation of the case by handling of the parts with the view of locating the seat of perforation.

DR. T. VEIEL of Constatt (*Viert fur Derm. et Syph.*) reports are markable instance of eczema of the face, caused by exposure to the rays of the sun, and for which, after all available remedies had been exhausted, relief was obtained by *wearing a red veil*. The patient was a lady aged fifty-six. Till twenty-four years old, she exhibited no unusual sensitiveness of skin; but at that time, when travelliug, in the month of April, severe swelling in the face came on without apparent cause. There were red wheal-like elevations, combined with swelling of the eyelids. These disappeared after four days' confinement in her room. Any exposure, however, to the sun, either in clear or cloudy weather, reinduced it. The same irritability returned next spring, to cease again in autumn and winter. This recurred every spring, but lasted each year a longer time; the infiltration of the skin was also greater. These attacks had recurred annually for fifteen years. Even in a closed apartment, the side of the face turned to the light, if near the window, showed some irritation, manifested by a papular eczema. Shortly after sunset and at night she could go out in all winds and states of the weather. Even in the keenest east wind the skin was unaffected. Of many and various external remedies none gave relief; most of them increased the irritation.

Dr. Veiel next sought to discover what property of the sun's rays induced this irritability. It was not the heat rays, for she could endure the glow from a fire or oven unaffected; nor the ordinary rays of light, since neither lamp nor candle incommoded her. The chemical rays were next considered; and it was found, in accordance with the experience of photographers, that a red veil limited their influence most completely. She was accordingly provided with a red veil, and sent out iuto the open air in the height of the day. The veil proved invaluable; for she who could not leave her room for two minutes in July and August in the forenoon, remained out, with its aid, repeatedly and without harm, for forty minutes at a time.

It is suggested that excursionists should substitute the blue veil, usually worn as a protection from the sun, with a red one, since blue affords the very least protection against the chemical rays of the sun.

Dr. Shirmunsky of St. Petersburg (*Monatschr. f. Ohr.*) reviews the different artificial membranes for the cure of perforated tympani that have been suggested. Berthold was the first to suggest and use the membrane of the hen's egg to close these perforations. Dr. Shirmunsky has tried this method in several cases with the best result, and reports a case where there was an ulcer in the external auditory canal, following an operation. A piece of the egg membrane was nicely adapted to the sore, and in seven days it fell off, leaving the part entirely healed.

In the case of a boy, where the drum of the ear was gone, and discharge persisted, Dr. Shirmunsky transplanted the egg membrane. The discharge diminished markedly, and a second transplantation stopped the same. The membrane is thrown off after a few days, and works by shielding the inflamed parts from outside hurtful influences.

Iwanow (*Wratsch.*) found, in the examination of a hundred and thirty-four healthy young recruits, only twelve who had pupils of equal size.

According to Jordanis (*Bul. Gen. de Therap.*), very satisfactory results may be obtained from the employment of electricity in atrophy of the mammary glands, in those cases where, after delivery, the mammæ are small and shrunken, and do not secrete milk. In a case reported, the patient had been confined eight days; but the child was not put to the breasts, as they were small and soft, and not secreting milk.

Electricity was applied, and after a few *séances* the breasts became firm and rounded, milk was secreted, and the infant was suckled. The improvement was lasting. The faradic current was used; the positive pole was placed over the breast, but the intensity of the current is not recorded.

Dr. A. L. Smith (*Canada Medical Record*) reports the use of electricity in causing the disappearance of a large "seed" wart on the index finger, of three years' growth, upon which nitrate of silver, nitrate of mercury, and various acids had no effect of a curative nature. He passed a steel needle, attached to the negative pole of the galvanic battery, well into the substance of the wart, on three different occasions, at intervals of three or four days, with the result, that in three weeks' time, the wart was entirely gone, leaving so little mark that its site was scarcely discernible.

Professor Parvin treated a case of umbilical hernia in an infant by reducing the hernia, pinching the skin together, and painting with collodion, and ordered the painting to be repeated three times a week. This superseded the truss, which caused too much irritation.

D. Boni recommends (*Giorn. Farm. Trent.*) a new blistering liquid composed of camphor, twenty parts; chloral hydrate, thirty parts; cantharides, ten parts.

The pulverized camphor is mixed with the chloral hydrate, and heated to 140° F. until fused. The bruised cantharides is then added, and the mixture digested at 140° to 158° F. one hour, with occasional stirring, then strained, and preserved in a glass-stoppered bottle. It is to be applied by a compress, or, in cases of children or delicate women, simply pencilled over the surface. Being non-volatile is said to give it an advantage over cantharidal collodion.

An application for gout and rheumatism is made of ether, fifteen parts; flex. collodion, fifteen parts; salicylic acid, four parts; morphine, one part. M. Paint hourly on the affected joints.

In a case of severe iodoform poisoning, the *Rép. de Pharm.* states that Dr. Behring recently gave a twenty per cent solution of bicarbonate of potassium. The best results followed its use, it seeming to act as a direct antidote to iodoform.

In smallpox the following ointment is said (*Medical and Surgical Reporter*) to act as an anæsthetic and antiseptic, and to prevent pitting: ℞. pulv. iodoform, half-drachm; vaseline pur., one ounce; pulv. camphor, one drachm. M. ft. Ung. Apply by gentle inunction to the affected skin.

Seltzer-water allowed to flow slowly but constantly from a siphon bottle upon a burn, is said to instantly relieve pain, and to hasten final cure.

CARE OF THE EARS.

The usefulness and importance of the organ of hearing to civilized man is not properly appreciated until its functions have been temporarily interfered with, and some of the many symptoms of disease have been experienced. Nature speaks to us oftenest "in the still, small voice;" and if we have learned to listen, and can rightly interpret her meaning, we may be guided by her precepts, and avoid danger. We are too apt to neglect the ears. Even if we become conscious of having such organs, we do not know what the natural condition is, and when disease comes we are more ignorant still.

The outer ear (with a canal leading inwards to the drum membrane), the drum cavity, and the labyrinth compose the organ of hearing, — an external, a middle, and an inner ear.

We cannot see or reach far beyond the external ear, or the auricle. Just within the entrance to the canal, and above on its upper wall, are placed the glands which secrete the wax which aids in preventing entrance of insects. Nature has very cunningly arranged for the natural removal of the excess of this secretion by causing it to form in the upper part of the canal, from which, when it becomes dry by exposure to the air, it may fall upon the floor of the canal, which, just beneath it, forms an inclined plane outwards. If one knows this fact, he need not try to aid nature in removing the wax; for, in so doing, he will most probably defeat her plans by pushing the wax far within, where the canal slopes in an opposite direction, and will leave it within the rigid walls of the bony portion. Many people incautiously make themselves deaf by using a towel or handkerchief rolled in the shape of a wedge, or, worse than this, some ingeniously constructed device "to assist nature" with.

All sensations, such as of fulness, burning, itching, or pain, as well as peculiar noises or sounds heard in one's ears, though suggesting the presence of disease, should not be self-treated. These various feelings, the noises and the pain, all mean something, and, if constant or recurrent, should arouse the patient to make inquiry as to their causation. Where there is itching, a diseased condition of the skin is to be found, and may be temporarily relieved with warm weak saleratus-water dropped into the canal. It is best to refrain from picking the ears, because foreign substances of an irritating nature, and dirt, so called, may be left upon the very delicate and highly sensitive skin. The ears should not be syringed; and, above all, no "sweet oil" or mixtures containing fats should be turned into the canal.

In all cases of earache, unless soon recovered from, the sufferer should have the ear examined, instead of first trying the effects of poultices, "ear-ache drops," onions, or tobacco-smoke. *These need never be used to relieve painful ears.* Oftentimes the earache is only a sign of disease in distant parts; as, for instance, decaying teeth often cause reflex pains in the ear. How absurd, then, the practice of filling the ear-canal with various nostrums! Usually, and almost always in children, an earache signifies inflammation within the drum cavity, and one should seek for other signs to decide if such is the case. Stop up the *good* ear, and have the patient asked a question. If he replies promptly, he hears readily; if not, there is disease. In such cases, an accurate knowledge of the condition of the ear must be had before rational treatment can be given.

The common practices among all classes of people, like those above referred to, cannot be too strongly spoken against. If there is any thing serious, the oils, pieces of cotton, lotions, and so forth, produce more trouble, and prevent oftentimes an otherwise easy examination of the affected organ.

It is not possible to give general directions for the relief of earache, though we may refer to two methods of procedure which often avail in the early stages of tympanic inflammation. These are the application of dry heat over the ear, and having the upper air-passages (nose and throat) cleared of existing obstructions. We here emphasize the importance of giving early attention to what may seem matters of trivial account; for usually one finds that the predisposing causes leading to the disease of the drum and adjacent structures extend from the nose or throat. Young children furnish by far the largest number of patients suffering with earache, and they are the ones who have not learned how to "blow the nose," and so mechanically open the passages through which the air finds its way within the tympanum.

There are certain sounds having their origin inside the head which are physiological and natural, produced by the ordinary movements of muscles and structures about or near the ear. Unheard, or not taken notice of, by the ear in health, they become the source of considerable annoyance when apparently magnified by the ear in its diseased state. To illustrate this, it is necessary only to tightly close the ears, and listen to such sounds as are made by speaking, swallowing, or chewing, and noting how much more loud they seem. In such a way, an obstruction placed within the canal, as wax, fluid exuded into the drum cavity or into the tissues by swelling, may stop the passage outwards of sound, cause it to rebound upon the nerve of hearing, and so be interpreted by our perceptive faculties as "noises." It is thus that the murmur of the blood-current in its rush through large blood-vessels within the bone and very near the ear, the crackling and snapping sounds heard in certain conditions of the middle ear, and sometimes even the noise made by the movements of muscles themselves, become annoying.

There are other shrill, "ringing" sounds produced in different ways from other coarser ones which are even more distressing, and are very difficult to drive away, if their warning notes have not been early heeded by the patient. They are produced in the labyrinth; and, while very seldom the result of disease there, they should not be allowed to continue long unnoticed, because they always are the precursors of a very intractable form of disease, which usually brings deafness. — *Boston Journal of Health.*

THE STIMULUS OF A CHANGE OF AIR.

Dr. Alfred J. H. Crespi of England has written a very practical paper on the "Change of Air as a Therapeutic Agent." The ideas are not exactly original, but the truth is very well and forcibly put by Dr. Crespi; and he takes a position somewhat counter to that which fashion has assigned to the

majority. After sketching agreeably the pleasure and profit of a change of air, he qualifies his eulogy of its therapeutic power by saying, that, in order to be benefited, one must not put one's worries in one's handbag, and carry them about. Many persons who are "ordered" to the seashore or mountains, go there grumbling under protest, and spend the precious days of would-be recuperation in longing to get back to the duties that haunt them. This sort of a "change" is a mere farce, but often it is the only kind that is obtainable. People are too poor to count the outing as a pleasure: it is an expense over which they fret till the last vestige of benefit is worn away. On this account, the physician must beware of flippant advice to try the seashore and mountains, when such a change may involve expenses which are hard to bear, and may lead only to heavier burdens thereafter. Unfortunately, the people who are overworked, — the middle classes, — who, with the tastes and aspirations of the rich, have only very limited means at command, are the very ones who most need the change, and get it with the greatest difficulty. Before prescribing a change of air, it is well to estimate the labor involved in getting it, — as to whether the effect of the tremendous effort necessary may not outweigh the results of the change.

In ordering change of air, it is wise not to promise too much. Do not pack people off to some distant clime, as some physicians do, because they do not know what to do with them. One ought to consider well before advising climatic changes in the case of a person presumably incurable. The excitement of a journey often hastens death in persons who are very low; and, if death ensues, it is very sad and inconvenient to the friends, and very prejudicial to the physician's fame. At best a change of air ought only to be *suggested;* coercion does no good. If the patient doesu't want to go, has whims, fancies, and so on, let her be: a change would effect nothing. So far as it is possible without injury, sick people should have their own way. "Taking it as a whole," says Dr. Crespi, "regarding the matter in the light of a philosopher and of an experienced practitioner, I contend that change of air is a less potent factor for good, a less reliable therapeutic agent, than commonly supposed, and that it needs using with consummate care and discretion, always following the patient's tastes, and always having due regard to his circumstances. In many cases change is inexpedient; in some, most injurious; in others, it should only be permitted after a long and confidential interview with client and friends, and after the latter have been carefully prepared for the probable results." — *Medical World.*

A NEW HYPNOTIC.

In the *New York Medical Record* Dr. E. C. Wendt describes sulfonal, a new hypnotic. Chemically this substance enjoys the euphonious designation of "diæthylsulfondimethylmethan." It occurs in the form of large, flat, colorless crystals, which are tasteless and devoid of smell. Sulfonal is soluble in eighteen to twenty parts of boiling water. In tepid water the solubility is only about one to one hundred. The crystals dissolve more readily in alcohol, and alcohol mixed with ether. Acids and alkalies do not affect the composition of the body, which appears to possess considerable chemical stability. The crystals melt at a temperature of 275° to 260° F. According to Professor Kast of Freiburg, sulfonal is an hypnotic pure and simple. It does not compel sleep through a paralytic effect on the nerve-centres nor through a profound impression produced upon the vascular system. From numerous experiments on animals and many clinical observations on man, the action of this new remedy would appear to consist merely in the intensification of those factors that lead to natural sleep in the physiological sense, or in supplying the periodical desire for sleep in those cases where it is wanting. It is for this reason, probably, that the range of applicability of sulfonal is a more limited one than that of some other drugs employed as hypnotics. But sulfonal has none of the disadvantages inherent in the deadly narcotics, and it is much more reliable than any of the bromides. This new body does not disturb digestion, it is not constipating, it has no unpleasant after-effects, it is perfectly harmless, it does not invite the formation of "a habit," and, finally, it does not appear to lose its efficacy, even when employed for a long period.

MEDICAL MEMORANDA.

INSECT-STINGS. — The pain, according to Dr. Bernbeck (*London Medical Record*), is best relieved by applying flexible collodion containing 35 grains to the fluid ounce of salicylic acid. Pain is quickly relieved, and swelling of the part generally prevented.

MICRO-ORGANISMS.— M. Vignal, Paris, is accredited with the statement, that the mouth contains seventeen distinct species of micro-organisms. He concludes that they play an important part in the digestion of food.

MOUTH-WASH. — The British *Dental Journal* gives the following: —

Take resorcin, 2 drachms; vol. ext. eucalyptus, 1 drachm; aquam, ad 4 ounces; mix, rub up with magnesium carbonate, 2 drachms, and filter. One teaspoonful to the tumbler of water, used frequently as a wash for spongy gums, stomatitis, or after extraction, will be found valuable.

PERIOSTITIS OF THE JAWS. — The *Révue de Therapeutique* states that commencing superficial periostitis of the jaws may be promptly checked, and the pain cured, by painting with tincture of aconite and tincture of iodine, equal parts. The application should be intrusted to a physician only.

HUMORS.

A LONDON druggist displays the following card in his window: "Come in and get twelve emetics for a shilling."

COMPOSITION ON PHYSIOLOGY BY SMALL BOY. — The human body is made up of the head, the thorax, and the abdomen. The head contains the brains, when there is any. The thorax contains the heart and lungs. The abdomeu contains the bowels, of which there are five, — A, E, I, O, U, and sometimes W and Y.

HE WAS DISSIPATED. — In the chemical laboratory: —

"Professor, what has become of Tom Appleton? Wasn't he studying with the class last year? "

"Ah, yes; Appleton — poor fellow! A fine student, but absent-minded in the use of chemicals, very. That discoloration on the ceiling — notice it? "

"Yes."

"That's him."

THE *Indiana Medical Journal* tells of an American in Paris who was about to die. He ordered the following despatch sent by cable as soon as the last breath left his body: "Am dead. Corpse will follow by next steamer."

THE cheapest aud simplest gymnasium in the world — one that will exercise every bone and muscle in the body — is a flat piece of steel notched on one side, fitting tightly into a wooden frame, and, after being greased on both sides with a bacon rind, rubbed into a stick of wood laid lengthwise of a sawbuck.

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SETH C. BASSETT,
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SPECIAL NOTICE.

The Publishers of the NEWS earnestly request that subscribers will make their remittances either by draft on Boston or New York, or by a postal order. If it is absolutely necessary to mail money, it should be sent ONLY IN A REGISTERED LETTER. The publishers decline to assume the risk of money mailed in unregistered letters.

Remittances will be duly credited on the printed address label of the paper; but if they are received after the 15th of the month, the change in the label cannot be made until a month later. If a formal receipt is desired, a two-cent stamp or a postal card should be enclosed with the remittance.

Publishers' Column.

FOR writers' paralysis use a rubber penholder and Esterbrook's turned-up-point pens, Nos. 309, 256, and 1876.

THOSE wishing a first-class shoe for a little money are referred to the advertisement of MESSRS. SWETT & SHERWOOD. The firm is a thoroughly reliable one, and will send their goods by mail to all parts of the country.

DR. C. C. CLARK, Oswego, N.Y., says: "I have made sufficient experiment of COLDEN'S LIQUID BEEF TONIC to enable me to say it is by far the best of all the preparations of the kind (food and tonic) that I have ever used. To the sufferer from chronic diseases, or the convalescent, it is invaluable, being both nourishing and strengthening.

A RECENT number of the *Scientific American* contained a full illustrated description of the works of MESSRS. J. W. QUEEN & Co. of Philadelphia, one of the largest manufactories of scientific instruments in the world. In addition they import largely from the best English and European makers. Illustrated catalogues of apparatus pertaining to any branch of science will be sent upon application.

IN 1879 DAVID BOYLE built the first refrigerating machine in the Empire Brewery of the Ph. Best Brewing Company, Milwaukee, and gained their confidence, so that they have since then purchased three more fifty-ton Boyle machines, and intrusted the whole refrigeration of their immense brewery to these machines. They are perfectly satisfied with their machinery today.

DR. W. W. GARDNER, Springfield, Mass., says: "It seems almost tautological to recommend HORSFORD'S ACID PHOSPHATE, a valuable local and stomach tonic. I have made use of it in my family and in practice for years. I will, however, repeat what my practice confirms: that I value it, when takeu according to directions, as an excellent preventive of indigestion, and a pleasant acidulated drink when properly diluted with water, and sweetened."

ATTENTION is called to the advertisement of MESSRS. HENRY THAYER & CO., Cambridgeport, Mass. Their NUTRITIVE is prepared for use in cases of malnutrition or non-assimilation of food, and especially for use in convalescence following prolonged sickness. The agents used in its composition seem remarkably well adapted for this purpose.

WE notice that the increasing business of the well-known advertising agent MR. J. H. BATES has necessitated a removal to more commodious quarters at 38 Park Row, New York. Mr. Bates is an old acquaintance of nearly all the publishers in the country, as well as the leading advertisers; aud we are glad to learn that his honorable and accurate methods of busiuess have secured him a well-deserved success.

THE twenty-first year of the NEW ENGLAND CONSERVATORY OF MUSIC, Boston, which has just drawn to a close, has been the most successful in the history of that phenomenally successful institution. Nearly 2,300 pupils have received instruction in its several schools of music, art, oratory, languages, literature, piano aud organ tuning, physical culture, etc. Every State aud Territory, and many other countries, have been represented in its halls. The ablest artists and teachers are in its Faculty, and yearly additions are made from American and European resources.

The Popular Science News

AND

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CONTENTS.

FAMILIAR SCIENCE.—The Photography of Moving Projectiles 113
Fire-Drawings 113
Kent's Cavern: its Wonderful Story of Prehistoric Man .. 114
Paris Letter 114
Trap-Door Spiders and their Nests 115
The Grand Magnet at Willett's Point 116
An Unpolishable Diamond 116
Scientific Brevities 116

PRACTICAL CHEMISTRY AND THE ARTS.—Glass-Making .. 117
Magic Mirrors 117
Metallic Alloys 117
Facts about Railroads 118
Procuring Chemicals under Difficulties 118
Workshop Hints 118

HOME, FARM, AND GARDEN.—A Tent of Living Vines 119
Selected Receipes 119
How to Blanch Celery 119
The Luxury of a Rose-Jar 120
How to Cleanse Chamois 120
To Keep a Room Cool 120
Household Hints 120
Gleanings 120

EDITORIAL.—The Future of Chemistry 121
Precipitation 122
A Fossil Human Footprint 123
The People and the Schools 123
Meteorology for June, 1888 123
Astronomical Phenomena for August, 1888 124
Literary Notes 124

MEDICINE AND PHARMACY.—Pneumatic Massage 125
Antiseptic Surgery 125
Monthly Summary of Medical Progress 126
A Philosopher's Prescriptions 126
The Anæsthetic Revelation 127
Salicylic Acid in France 127
The Feeding of Children 127
Anti-Vaccination Theorists 128
Medical Memoranda 128

PUBLISHERS' COLUMN 112

Familiar Science.

THE PHOTOGRAPHY OF MOVING PROJECTILES.

SOME time ago the fact was noted in this paper that a European scientist had succeeded in obtaining a direct photograph of a bullet in motion, just after being discharged from the gun. We reproduce from *La Nature* some engravings made from photographs obtained by Professor Salcher of Fiume, Austria.

It is evident that the air in front of a body moving as rapidly as a bullet must be more or less condensed; and, on the contrary, the air behind it will be somewhat rarified. As the refractive power of air varies with its density,

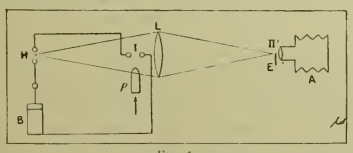

FIG. 1.

these effects ought to be shown very plainly in a photograph, where the light affecting the plate passes through these strata of air of varying density; and, on inspection of the engravings, we find the head, or wave of condensed air, in front of the projectile very clearly marked. We also see in the rear of Fig. 3 the spiral eddies or whirlpools formed in the rarified air behind it.

When it is remembered that the velocity of these bullets at the moment of their being photographed was from thirteen hundred to sixteen hundred feet per second, it would seem almost impossible to impress their image upon the sensitive plate. The diagram (Fig. 1) shows the prineiple upon which the feat was accomplished. The camera, *A*, is placed at the proper distance; and in front of it is placed a screen, *E*, which cuts off all rays of light, except those proceeding from the projectile.

FIG. 2.

FIG. 3.

FIG. 4.

FIG. 5.

At *L* is a lens which concentrates the image upon the camera. *B* is a Leyden jar, with wires attached connecting the outer and inner surfaces. The circuit is interrupted at *H* and *I*. The projectile *p* is fired in such a direction that it passes between the wires at *I*, closing the circuit, and causing an electric spark to appear both at *I* and *H*. The former spark illuminates the projectile, and the light from the other passes through the air surrounding it. It will be seen that the action is entirely automatic; the flying bullet illuminating itself at just the right moment, and for a small fraction of a second only. The whole action is practically instantaneous, and shows the wonderful sensitiveness to which the modern dry plates have been brought. The time of exposure of the plate must in these cases have been less than one hundred thousandth of a second.

In Figs. 2 and 3 the projectile was moving at the rate of thirteen hundred feet a second. These show the layer of condensed air in front of it particularly well. Fig. 5 shows, in addition, the electrodes or wires between which the bullet passed, while Fig. 4 shows the eddies and little aerial whirlpools behind it. The velocity of the projectile in the last two figures was sixteen hundred feet a second.

The original photographs were necessarily very small, only about three-sixteenths of an inch in diameter; but they were carefully copied and enlarged by the engraver, without exaggerating the details in the slightest degree.

FIRE-DRAWINGS.

A VERY amusing scientific experiment may be performed by taking a saturated solution of nitrate of potash (saltpetre), and, with a quill-pen or fine brush, drawing any picture, design, or words upon a piece of white absorbent paper. The lines should be kept away from each other; and the entire subject coarsely drawn in outline, like the elephant in the illustration. When dry, the lines will be nearly invisible; but if one of them be touched with the glowing end of an extinguished match, a spark of fire will run through the paper, following the lines already traced, and cutting out the design as if with an invisible knife.

This experiment is explained by the chemical constitution of the saltpetre. This salt contains a large amount of oxygen, so loosely combined that it readily leaves the nitrogen and potash, and unites with the carbon of the paper, when heated to the point of ignition. The heat developed by the combustion is not sufficient to ignite the paper, except where it has been saturated with the oxygen-giving salt; and so the spark of fire, which is really only an indication of a violent chemical reaction, follows the lines previously traced. If an actual flame was brought in contact with the paper, of course the whole would be consumed; but the heat of the glowing charcoal is just sufficient to start the combustion, by the aid of the oxygen in the saltpetre.

The explosion of gunpowder is due to the same cause. It is composed of charcoal (carbon), sulphur, and saltpetre, intimately mixed.

When brought into contact with a spark of fire, the oxygen of the saltpetre combines with the carbon and sulphur so rapidly, that the combustion is almost instantaneous; and a large volume of carbonic and sulphurous acid gases is formed with explosive rapidity. The instability which the presence of nitrogen confers upon a molecule is well illustrated in this case. Nitrate of potash (KNO_3), as we have seen, gives up its oxygen with the utmost ease; while carbonate of potash (K_2CO_3), which only differs from it by the substitution of carbon for nitrogen, is one of the most stable of substances, and is only decomposed under the influence of powerful chemical reagents.

[Original in *Popular Science News.*]

KENT'S CAVERN: ITS WONDERFUL STORY OF PREHISTORIC MAN.

BY SAMUEL BRAZIER.

PART I.

That the body and mind of man have been slowly developed during immensely long periods of time, before any thing like what we call civilization was possible, is an opinion now pretty generally entertained. That man has lived on the earth for hundreds of thousands of years is certain: that he may have lived here for millions of years is possible, and even probable. His great antiquity, his existence as a contemporary of races of animals now extinct, that he has lived during changes of climate vastly greater than any that have occurred during the historic period, and his existence on the earth when parts of the present continents were submerged beneath the seas, are facts made evident by the revelations of geology during the present century. Much of this evidence of man's antiquity, and of his habits of life during prehistoric ages, has been obtained by the examination of caves, which in all times have been the ready-made homes of men as well as of other animals.

In many of these ancient dwelling-places are found the teeth and bones of great numbers of animals, both of extinct and of surviving species, buried together, with flint or bone knives, combs, scrapers, arrowheads, saws, hatchets, hammers, and other human implements.

One of the most interesting of such caves occurs in the county of Devon in England. On account of its beauty, Devonshire has been called the garden of England. On its southern coast, which is washed by the waters of the British Channel, stands one of the most frequented of English watering-places, known as Torquay. Near to this town there is a large cave, known from time immemorial by the name of Kent's Cavern.

The origin of the name is unknown. For a hundred years it has been frequented as a place of curiosity by visitors to Torquay; and the guides repeat a tradition that a dog was once taken into the cave, and lost there, and that it was subsequently found in Kent, about a hundred miles away. It was therefore supposed that a subterranean passage extended from Devonshire to Kent and so the cave was called "Kent's Cavern." This is probably only idle gossip, and no one knows when or why the cave received its name. It is situated in one of the beautiful valleys of Devonshire, and may be entered through either of two apertures in a vertical limestone cliff that rises to a height of about thirty feet.

Bones were first discovered in the cave in the year 1824 by a Mr. Northmore and by Sir Walter Trevelyan. In the following year a more systematic examination of the cave was made by the Rev. John McEnery, who discovered a great number of teeth and bones of animals now extinct. Speaking of some of the first fossils he disinterred, he says: "They were the first fossil teeth I had ever seen; and as I laid my hand on them, relics of extinct races, and witnesses of an order of things which passed away with them, I shrank back involuntarily."

The excitement was not likely to grow less as his work proceeded. He found in this cave the remains of the following animals: elephant, rhinoceros, several species of horse, two species of ox, Irish elk, two species of red deer and another species smaller than the red, reindeer, hyena, lion, wolf, fox, bat, weasel, lagomys (an animal now found in Siberia), mole, land-rat, water-rat, vole, three species of bear, and an animal called *Machairodus latidens*. But he not only found the remains of these animals, representing arctic, temperate, and torrid climes, and belonging to species long since extinct: what was more surprising and more significant was the discovery with them of the evidences of human existence in the form of human implements, showing that man had lived on the earth at the same time as these extinct races of animals. Piercing through the stalagmite which formed the solid floor of the cave, he found in the red earth beneath, buried with the remains of extinct animals, flint arrowheads and lance-heads, which testified to the existence of man. He says, "This electrified me." He called his fellow-laborers to witness the discovery, and in their presence dug out from the same spot the teeth of an ox, and flint arrowheads that had been made by man. He showed these flints to Dr. Buckland, who was so slow to receive this evidence of man's great antiquity, that he suggested the theory that the ancient Britons had probably used the cave, and made ovens in it, and that some of their flint implements might have fallen through crevices in the stalagmite into the red marl below.

This, however, seems impossible. It was hardly possible that the ancient Britons would break through several feet of stalagmite; and this solid limestone floor afforded no evidence of ever having been disturbed, nor could any traces of their ovens be discovered. Arrowheads and knives of flint, and other remains of human art, occur in all parts of the cave, and through the entire thickness of the clay, and in the same places as the teeth and bones of extinct animals.

The Torquay Natural History Society appointed a sub-committee in 1846 to explore certain parts of the cavern, and they found exactly the same kind of things that McEnery had found. Mr. Vivian, a member of this sub-committee, drew up a report, which was read to the British Association in 1847, and also to the Geological Society.

In this report, published in the British Association's *Transactions*, the following passage occurs: "The important point that we have established is, that the relics of human art are found under the unbroken floor of stalagmite. After taking every precaution by sweeping the surface, and examining most minutely whether there were traces of the floor having been previously disturbed, we broke through the solid stalagmite in three different parts of the cavern, and in each instance found flint knives."

In the present day, when our minds have become somewhat familiar with the idea of man's great antiquity as revealed by the science of geology, it is curious to look back forty years, and learn how these statements in reference to the discoveries in Kent's Cavern were received by the scientific world. We should rather expect that ordinary individuals who had been taught that the world was created four thousand and four years before the birth of Jesus Christ, would smile incredulously when told that man had really lived on the earth for hundreds of thousands of years, when it was inhabited by the Irish elk, the mammoth, the woolly elephant, the cave bear, and other races of animals long since passed away. But how were such statements received by the scientific world forty years ago? They were utterly rejected! Scientific men were not prepared to receive them, and doubted the facts which were offered in evidence of their correctness. Although Mr. Vivian's paper, as already stated, was read before the Geological Society, *The Quarterly Journal* of that society refused to publish the facts. Men of science were incredulous, and they based their scepticism mainly on two points: First, they hesitated to believe that flint tools, the work of human hands, had been found, with the remains of extinct animals. The gentlemen who had explored the cavern were clear in their statement of these facts; but scientific men refused to believe, objecting that the exploration had not been carried on in a sufficiently systematic manner. This, as we shall see, led to further researches, conducted in so systematic a manner as to compel the acceptance of the facts that were disclosed.

A second ground of scepticism on the part of scientific men had reference to the animal called *Machairodus latidens*. It was then called *Ursus cultridens*, and was supposed to be a species of bear, as its name implies. The remains of this animal had never been found in Britain. Animal remains of the same genus, though not of the same species, had been found in caves on the continent of Europe, the deposits in which were known to be older than those in Kent's Cavern; but none had ever been found in England. It was therefore doubted whether the remains of *Machairodus latidens*, which Mr. McEnery thought he dug out of Kent's Cavern, had actually been found there.

In 1864 the British Association met at Bath. A committee was appointed to carry on a careful and systematic exploration of the cavern. The committee consisted of some of the most eminent scientific men, such as Sir Charles Lyell, Sir John Lubbock, and others. This committee continued its researches for years under the personal daily superintendence of its honorary secretary, W. Pengelly, Esq., F.R.S.

(*Concluded next number.*)

[Special correspondence of the *Popular Science News.*]

PARIS LETTER.

As is usually the case, at the beginning of the summer season the inhabitants of Paris have to submit to the periodical plague of being compelled, in parts of the town, to use Seine water for drinking and other purposes. The rivers and springs which furnish Paris with water generally cease in summer to supply water enough for the requirements of the town, and the authorities in charge of the water-service are compelled to give Seine water in place of the usual supply. This generally provokes an outburst of indignation. It has been undeniably proved that Seine water does contain bacilli of the typhoid-fever, and the Parisian population objects to being refreshed with such poison. It is true, the engineers and civil authorities — non-medical — declare that the presence of typhoid bacilli is not exactly ascertained, and that, if it were, it would be of no importance. The Parisians believe more in physicians than in the unqualified authorities. It is really a shame, that, after the very exact and accurate researches made concerning the presence of typhoid bacilli in Seine water, such water should be once more distributed to an

important part of the city. But the Municipal Council is more occupied with politics, which are not its business, than with the hygienic conditions of Paris, which are part of the business which it is appointed for. However, under the pressure of public opinion, endeavors are being made to purchase new springs or rivers, and to bring more pure water to the city.

The progress of saccharin is becoming a matter of attention for the French government. A good quantity of sugar is made in France out of turnips, and the government feels it must in some manner protect this industry. The Minister of Agriculture proposes that some tax should be levied on the new sugar, which is gaining considerably in favor, as might be expected.

Some days ago, for the first time, a young lady has graduated Doctor of Science in the antique Sorbonne. Her thesis is good enough, although in no manner remarkable, and won for her the compliments of the jury. Frenchmen are always gallant with ladies, and the ladies know it, and take advantage of the weakness.

A long and important discussion has just been carried on, before the Paris Academy of Medicine, concerning leprosy and its etiology and contagiousness. Two of the best dermatologists of Paris have taken part in the debate, — MM. Besnier and Vidal, — and also a very experienced physician of the naval corps, Dr. Leroy de Méricourt. They have summed up all the facts known at present concerning the disease in Europe as well as abroad, in present and in past times; the documents from India, Canada, and the Sandwich Islands have been amply examined and discussed : and, as usual, the opinions differ. Besnier and Vidal are contagionists, and believe the Hansen bacillus to be the cause of the disease. M. de Méricourt believes more in heredity than in contagion. Each produces facts in favor of his own theory. We cannot much wonder at this, considering how very small is the number of theories, or even facts, that are really recognized by the whole of the persons that are competent to give a judgment thereon. It only shows how much remains to be done before we are in possession of some positive and undisputed facts, and of a good explanation of the same.

It is hoped, in scientific circles, that in the course of next year, during the great Exhibition, — if it comes off, and if no war or other trouble prevents it from being opened, — an international meeting of physiologists may be held in Paris. It is the Paris Société de Biologie that has the credit of having raised the question, and we hope the scheme may be a successful one. Physiology is yet a growing science, and much remains to be done in its sphere; and an annual meeting of physiologists would certainly prove beneficial to the interests of the science they have embraced. A committee is at present engaged in the study of the means by which the meeting might be decided. Apropos of the Exhibition, the Eiffel tower is progressing favorably. It attains at present a hundred meters, —the third of the height that it is to obtain. No particular difficulties seem to have been met with so far, at least, none have been spoken of.

Professor Grancher of the Paris Medical School has recently communicated an interesting paper concerning the influence of hydrofluoric acid on tuberculosis. This acid was proposed some time ago as a useful agent in the treatment of pulmonary tuberculosis, it being recommended that the patients should inhale air containing vapors of this acid. Many physicians have tried this system, and reported the results of their experiments in various manners, but generally in an unfavorable one. Professor Grancher, from a number of experiments, draws the conclusion that hydrofluoric-acid vapors do not certainly kill the tuberculosis bacillus, but may in a marked manner diminish the infectious properties of the bacillus, which is much attenuated. M. Grancher remarks that hydrofluoric acid is very well tolerated by patients, and that, such being the case, this method of treatment is a usefnl one, although it does not destroy the obnoxious bacilli. Professor Grancher's paper will be found in the *Proceedings of the Société de Biologie* (May, 1888), and may prove useful to physicians desirous to see how his experiments (on animals) have been conducted.

Professor le Denter recently showed, at a meeting of the Paris Academy of Medicine, an interesting case. It is that of a man whose sternum and part of superior ribs were entirely gone, through bone tuberculosis. In order to put a stop to the abscesses that were in progress, M. le Denter removed all the diseased parts of the bones, and the operation fully succeeded. It had, besides preserving the patient's life, the advantage of rendering the man a very interesting object of study for physiologists. The whole of the inferior two-thirds of the sternum being removed, and also part of the anterior extremities of the corresponding ribs, the result is, that the base of the heart and part of the aorta are very accessible to physiological investigation. This investigation has been carried out, through the methods at the disposal of modern physiology, by Dr. H. de Varigny, under Professors Chauveau and Richet's supervision; and the result is, that very fine graphic representations of the aorta pulsation have been obtained, which are quite identical with those obtained on higher animals. Details will be found in the *Proceedings of the Société de Biologie* and in the *Centralblatt für Physiologie*.

H.

Paris, *June* 20.

TRAP-DOOR SPIDERS AND THEIR NESTS.

In the hotter parts of the earth the threads spun by spiders are often of considerable strength and toughness, and in some cases are sufficiently strong to strike off the hats of passing travellers, or to be woven in looms, like the fibres of the silkworm.

All the trap-door spiders are remarkable for the great strength of their webs, which are used, not for the capture of prey, but for the strengthening of their earthen homes. The silk is mostly yellowish, and so tough that a nest may be removed without any danger of damaging it; and the silk is so strong, that, even when the earth has been dried and wholly removed, it will bear a considerable strain without breaking, and can be drawn over the finger like a glove. Up to this point the burrow possesses no advantage over that of the bird-spider, being a simple silk-lined tube. But the spider now sets to work at the construction of a door by which the opening may be not only closed, but concealed.

Guided by instinct, it weaves a circular web rather less than the diameter of the burrow, and works into it a quantity of earth. This process is repeated until the spider has constructed a circular plate of alternate layers of web and earth, nearly twice the thickness of a penny, and slightly conical. Eight or ten layers are employed in the manufacture of the plate. A small portion of this plate is attached to the lining of the burrow; the webs, indeed, of the plate being woven into those of the lining, and being a continuation of them.

The plate, therefore, forms a door with a silken hinge; and so accurately is it constructed, that, when it is closed, the upper surface is exactly level with the ground. It will be seen, therefore, that the aperture is effectually closed; but there are yet two points in the structure of the trap-door which must be noticed. In the first place, the spider takes care to cover the upper surface with earth exactly resembling the soil in which the burrow is sunk, even imitating the irregularity and roughness with astonishing fidelity, and fixing lichens, moss, or even leaves, on it, just as the chaffinch does on its nest. So perfectly is this done, that to discover a trap-door is almost impossible.

Strangers, when sitting on a bank, are often astonished at seeing a circular piece of earth lifted near them, the jaws and legs of a spider partly protruded, and quickly withdrawn when the intruder is seen. So rapidly does the spider pass back again into its burrow, and shut the door after it, that the movement has been aptly compared to that of a cuckoo in a clock. Even when the eye has been thus directed to the exact spot, it is not easy to find the door. If, however, it be found, and an attempt be made to open it, a tolerably strong resistance will be experienced. This is caused by the inhabitant, which holds firmly with its forelegs to the door, and hind legs to the lining of its web, and resists as long as it can. So firmly does it retain its hold, that, when the nest has been pulled out of the soil and torn asunder, the spider has come away with the upper portion, still holding the door against the foe. The marks thus made by the spider's claws may frequently be seen, especially in the doors of old nests, where frequent use has worn away the material.

The second point of interest in the trap-door is the mode in which it is fixed. The spider always chooses a sloping surface for its burrow, and the hinge is always placed upon the highest point; so that, when the spider issues forth, the door is self-acting, and shuts by its own weight.

The nest of a trap-door spider, (*Cteniza nidulans*) found in Jamaica, bears a curious resemblance to a very small yellow stocking; and the likeness is increased by the fact that in most cases the spider does not content itself with a single tube, but makes the last inch or two of the end at an angle just like that of a stocking-foot. The reason for choosing this form is rather doubtful. At one time it was thought that the spider altered the course of the burrow in consequence of coming across some obstacle, such as a pebble or root; but, as the bend invariably occurs at the same place, it is evidently intentional, and not accidental. This nest appears to be of the "cork" type

In the British Museum there is a remarkable example of a burrow with two trap-doors, — one in the usual place at the entrance, and the other an inch or two below it. The reason for this duplicate door was easily discovered. The nest had been made in cultivated ground. Earth had been thrown over the mouth of the burrow, and buried it. The inmate had therefore burrowed upwards until it had made its way into the open air, and had then constructed a second door.

It must be remembered that only the female spiders live in these nests, the males being very rarely found. The young spider, after quitting the nest of its mother, builds an exact copy of it in miniature, and as it grows, gradually enlarges its nest. In the wafer-doors the layers of silk and earth thus added are visible, but are better seen from the cork doors, and in these they may often be separated.

If the top part of the tube, with the lid, be removed, it will be found, on returning to the same spot in a day or two, that the spider has furnished a new door to the tube. The spiders are nocturnal

in their habits, frequently going out at night in search of prey. It is stated that the Californian "cork" spider (*Cteniza Californica*) fastens its door open with a silken thread before leaving its nest, the door being so difficult to open from the outside.

The greatest enemies of trap-door spiders in Europe are lizards and centipedes, and the spiders are always on the alert to guard against their attacks; so that, if the outer door of a double-door nest be opened, the spider immediately slams the inner door to, for fear of its pursuers. If the latter be forced open or removed, the spider will generally flee to the very bottom of her nest, where she will be found crouched up in terror. Owing to the complete concealment which the doors of the nests effect, the only way of detecting them in countries where trap-door spiders abound is to turn up all the likely-looking bits of earth until one of the nests is found. — G. H. BRYAN, *in Journal of Microscopy.*

THE GRAND MAGNET AT WILLETT'S POINT.

LAST December Major King happened to see two large fifteen-inch Dahlgren guns lying unused side by side on the dock. He immediately conceived the idea that a magnet of enormous power could be constructed by means of these cannon, with submarine cable wound about them. The experiment proved very successful. The magnet, which stands about ten feet from the ground, is eighteen feet long, and has eight miles of cable wound about the upper part of the guns. It is the largest and most powerful magnet in the world. Some faint idea of its power may be conceived from the fact that it takes a force of twenty-five thousand pounds to pull off the armature. A crowbar which was applied to the magnet required the combined force of four strong men to tear it away. A handful of pins thrown in the opposite direction immediately flew back, and attached themselves to the magnet. A seemingly impossible experiment was performed with some fifteen-inch cannon-balls. The balls were solid, and as much as a strong man could lift; yet the magnet held several of them suspended in the air, one under the other.

The most interesting experiment was the test made of an American non-magnetic watch. Ever since the great railroads of the country have compelled their employees to provide themselves with timepieces that would not be affected by the magnetism generated by the car-trucks, there has been much speculation as to whether such a watch could be made, and a sharp rivalry has been going on between the American and Swiss manufacturers. The test was highly satisfactory, and once more proved that, whenever a new invention was imperatively demanded, American genius could fully hold its own against the whole world. Major King's magnet was so powerful, that an ordinary watch was stopped stock still as soon as it came within three feet of it. Before the test was made, there was quite a diversity of opinion among the experts present as to how far it would prove successful.

Those who believed that a watch might be constructed that would resist magnetic influence under ordinary circumstances, were also of the opinion, that, when it was subjected to the most powerful magnet in the world, the steel pinions would bear so on the working parts, that the watch must necessarily stop. For ten minutes the watch was held in front of the magnet. It did not vary the hundredth part of a second. The man who held it said that he himself was conscious of the influence of the magnet. He could feel, as he held the watch by the chain, that some other power than his was keeping it suspended. The most amusing experiment was made with a sledge-hammer. When one tried to wield it in a direction opposite to the magnet, he felt as though he were trying to hit a blow with a long feather in a gale of wind. There is nothing in the world that could take the conceit out of a strong man so much as this simple experiment Another amazing test was made with a number of carpenter's spikes. A spike was put lengthwise on the end of the magnet, then another spike was attached to the first, and so on until a line of them stood straight out from the magnet at least four feet in length. — *New York Sun.*

AN UNPOLISHABLE DIAMOND.

A REMARKABLE diamond was exhibited at a recent meeting of the New York Academy of Sciences by Mr. George F. Kuntz. It was a compound or multiple crystal, containing a large number of twinnings. It is of the class termed "extreme durate" by the French. It had been cut into the general shape of a brilliant, and its main face or table was then placed on the polishing wheel. It was kept there for a hundred days, the wheel revolving at the rate of 2,800 revolutions per minute. The diamond was held upon the rotating surface at a distance of about 15 inches from the centre. Based on these figures, a calculation showed that the surface passed over by the diamond amounted to 75,000 miles, or nearly three times the circumference of the earth. Yet it was all futile, as the stone would not acquire a polish. The ordinary weight placed on a diamond while on the wheel is from 2¼ to 2½ pounds. This was increased by 4 and 8 pounds without effect, and finally 40 pounds were used. The wheel was badly damaged, the diamond ploughing into it, and throwing scintillations in all directions. The diamond, even under these conditions, could not be given a commercial polish. The wheel had to be replaced. — *Scientific American.*

SCIENTIFIC BREVITIES.

DANGEROUS PHOTOGRAPHY. — An attempt was recently made in Dublin to photograph a lioness with the head of the tamer in its mouth. The animal, wearied by the tension of her maxillary muscles, or scared, it may be, by the sudden flash of the magnesium light, tore the woman's cheek completely open. Fortunately, no more serious injury resulted, the lioness being beaten off in time to prevent a threatened catastrophe.

THE MOON'S HEAT. — From observations upon the total lunar eclipse of last January, Professor Boedicker found —

That the heat radiated by the moon begins to decrease a considerable time before the first contact with the penumbra.

That 22 minutes before the beginning of totality the heat is only 4.7 per cent of the value obtained 1 hour and 10 minutes before the first contact with the penumbra. Unfortunately, an unforeseen stoppage of the driving-clock prevented the observations from being carried on closer up to and during the total phase.

That, in spite of the rapid fall on approach to totality, the heat, after the last contact with the penumbra, does not at once increase to any thing like the value observed at corresponding times before the first contact.

NATURAL GAS. — Analysis of natural gas shows the proportion of each constituent in 100 parts of the gas to be as follows: Carbonic acid and carbonic oxide, $\frac{6}{10}$ each; oxygen, $\frac{8}{10}$; olefiant gas, 1; ethylic hydride, 5; marsh gas, 67; hydrogen, 22; nitrogen, 3.

THE PRINCIPAL LANGUAGES. — It has been estimated by Professor Kirchhoff of Halle that the language most spoken on the globe — for the last thousand years, at least — is Chinese, for it is without doubt the only one which is talked by over 400 millions of the human race. The next language most in use — but at a very great distance behind Chinese — is Hindustani, spoken by over 100 millions. Then follow English (spoken by about 100 millions), Russian (over 70 millions), German (over 57 millions), and Spanish (over 47 millions).

CROOKES'S RADIOMETER is being used in France for timing the exposure of photographic plates; an equal number of revolutions of the vanes of this little instrument corresponding to the proper time of exposure, whatever the degree of brightness of the light.

PROFESSOR WOLCOTT GIBBS has resigned the Rumford Professorship in Harvard University in order to devote himself exclusively to research. He has removed to Newport, R I., where he is erecting a private laboratory.

THE ATOMIC WEIGHT OF ANTIMONY. — Pfeiffer and Popper have proceeded by the electrolysis of a solution of antimonious chloride, and have obtained the values 120.72, 120.82, and 120.54, — figures which are a unit higher than the value found by Cooke.

A "WOOLLY CROCODILE." — A curious creature is said to have been brought to San Francisco by a ship which arrived there the other day. It has some characteristics of the crocodile, but is covered with a coat of short bristles or hair, which gives it a most peculiar appearance. It has been domesticated to a certain extent, and will permit the captain or any of the crew to approach it, and receives their caresses with evident pleasure; but if a stranger approaches, it distends its big jaws, and shows fight. The crew call it a "woolly crocodile." It is active, and weighs about forty pounds.

AN ANCIENT PROCESS FOR RENDERING JEWELS PHOSPHORESCENT. — The collection of the Greek alchemists found in certain MSS. of the thirteenth and fifteenth centuries in the National Library describes processes used for the artificial coloration of factitious jewels, emeralds, carbuncles, and hyacinths. Stones were to be made luminous in the night by dyeing them with a mixture of copper-rust and of the gall of the tortoise. A finer color was obtained by using the sea medusa instead of the tortoise. This coloration was, of course, not permanent; but it was easily reproduced

SNOW FROM A CLEAR SKY. — On Jan 3 snow fell in Christiania from a perfectly clear sky. After a strong southerly wind, with cloudy weather in the morning, the weather cleared, but at about noon it again thickened, and snow and sleet fell. In the afternoon the sky again became clear, and continued thus, with a storm blowing from the west. Just before eight P.M., however, thick clouds again gathered, the full moon became obscured, and snow began to fall heavily. A quarter of an hour later the wind swept the clouds away, and the sky became completely clear, with the exception of a few clouds in the east. The stars shone brightly, and the full moon illuminated the landscape; still snow continued to fall thickly for some ten minutes. That the snow could not have originated with the clouds in the east, is proved by the circumstance that the wind was westerly. A well-known meteorologist ascribes the phenomenon to the presence, at a certain elevation in the atmosphere, of a very cold layer of air, in which the ascending comparatively warmer air became condensed; the moisture being thrown out in the form of snow, but not in sufficient quantities to obscure the blue sky, the stars, and the moon. The great chilling of the layer of air referred to may have been caused by the coldness of the heavy snow-clouds which a few minutes previously filled the atmosphere.

Practical Chemistry and the Arts.

GLASS-MAKING.

The first discoverer of glass is unknown. The familiar story of the Phœnician sailors building a fire upon a sandy beach, under a kettle supported by blocks of soda, has no foundation in fact; and, moreover, glass beads have been discovered in prehistoric tombs of unknown antiquity.

Chemically, glass is a silicate, or a compound of silicic acid and various bases. It is formed by fusing silicic acid (common sand) with the carbonates of the alkalies, and in some cases with metallic oxides. Ordinary window-glass is a silicate of lime and soda. Plate glass contains, in addition, some silicate of potassium. Crown glass is now rarely used, except for optical purposes, and is a silicate of potassium and lime. Flint glass, which is commonly used for table-ware and ornamental purposes, is a silicate of potassium and lead. It is made by fusing three hundred parts of the purest white sand, two hundred parts of red oxide of lead, one hundred parts refined pearlash, and thirty parts of nitre. The effect of the lead is to give increased brilliancy, and renders it soft and easily cut. The nitre is added to oxidize any accidental impurities, which might otherwise reduce the lead to the metallic state.

Bottles and similar coarse ware are made from impure materials, and the dark color is due to the presence of iron. Very few sands are entirely free from iron, but a mere trace is sufficient to injure the color of the glass. The best sand in the world for glass-making is found in Berkshire County, Mass., and is sent to all parts of the country.

The materials are mixed together, and fused in pots or crucibles of burnt clay. These pots are very likely to break when submitted to the heat of the melting-furnace, and must be prepared with the greatest care, only the very best quality of clay being used. A comparatively low heat is applied at first, so as to drive off the moisture and carbonic acid, and cause the materials to partially melt together. It is then increased until the whole mass is in a state of fusion. The various impurities rise to the top, forming a scum known as "glass gall," which is removed with iron shovels.

After the materials are entirely melted, the heat is continued for some time, so that the glass is kept in a thinly fluid condition. This allows the impurities to settle to the bottom of the pot, and the glass to become clear and uniform in quality. The temperature is then lowered to about 1500° F., at which point the glass loses its fluid consistency, and becomes pasty, and fit for blowing or working into shape.

The tools of the glass-blower are of the simplest possible description. The principal one is the blowpipe, which is merely a tube of iron. The glass-blower takes a sufficient quantity of melted glass upon the end of this tube, and by blowing into it with his breath, and various dexterous manipulations, in a few moments transforms it into a beautiful goblet or other useful or ornamental article. Glass-blowing is almost altogether a matter of personal skill and dexterity, and a skilful glass-blower commands high wages; but the work is very exhausting, and liable to produce diseases of the lungs.

After the glass is blown and cooled, it remains in a state of internal tension; that is, owing to the rapid and uneven cooling, the glass is strained in different directions, rendering it very liable to fracture. Such a strain was formed in a piece of glass for one of the lenses of the great Lick telescope, and detected by the aid of polarized light. It was, however, determined to proceed with the cutting, with the result that the glass split into three pieces during the process. To relieve these strains, and allow the molecules to become better acquainted with each other, the articles of glass are placed in a long annealing furnace, which is kept very hot at one end, and cool at the other. The glass is slowly moved through it by machinery, taking a day or more to complete the journey, and, by this gradual cooling, is rendered fit for use.

Ordinary "German" window-glass is made by being blown out into a cylinder which is then split and rolled out flat. Plate glass is cast by flowing it over a metal table, and is afterwards ground flat, and polished. The bronze casting-table in use at a factory in France cost twenty thousand dollars. In the process of grinding and polishing, the glass sometimes loses half its original weight and thickness.

Cut glass is a fine variety of flint (lead) glass; and the "cutting," — which is really a grinding process, — is done on wheels, and requires the greatest skill and experience. Pressed glass is an imitation of cut glass, and is made by pressing the melted glass into a mould. Some of the finest pressed work is almost equal to that cut by hand.

Soluble or water-glass is an alkaline silicate, containing a large proportion of the alkali. It is readily soluble in water, and is largely used in the arts. A glass containing a large proportion of lead as a base is known as *paste*, and used to imitate precious stones. The coloring of glass was described in the May number.

Glass for optical instruments must be made with the greatest care; and it is difficult to obtain it free from bubbles, spots, and layers of unequal density. On account of the greater refractive power, very heavy glass is desirable for lenses and prisms. This is obtained by the use of a large percentage of lead. Thallium, molybdenum, boron, and tungsten have also been used to a limited extent; and a silicate of lead made by Faraday many years ago possessed so high a refractive power, that it became quite celebrated. Professor Tyndall, in his lectures in this country, made use of some of Faraday's glass.

Few things have contributed more to the comfort of mankind, both directly and indirectly, than glass; but it is only in comparatively modern times that it has been produced so cheaply as to come into universal use. For many hundred years it was an article of luxury only, and glass windows are specially taxed in some European countries to the present day. While the cost of manufacture will probably never be much less, the quality and beauty of glassware is constantly improving; and the poorest person may now use on his table, every day, glassware more beautiful than a king could obtain not many years ago.

MAGIC MIRRORS.

There are occasionally brought to this country, from Japan, mirrors of thin polished metal, on the back of which are figures and designs cast in relief. Some of these are known as "magic mirrors," from the singular fact, that, when the sunlight is reflected from one of these mirrors upon a screen or wall, the design on the back is reproduced in the reflection, apparently as if the metal was transparent. The cause of this remarkable effect has been unknown until quite recently, when Mr. F. E. Ives discovered the true explanation. It seems that, after casting the mirrors, the front surface is polished by being held by the back against a revolving wheel. As the polisher presses the mirror against it, the thinner portions spring back, or "give," a little, while the thicker parts formed by the raised figures do not yield as much, and consequently are ground down a little deeper. This difference in the surface, while not perceptible to the eye, is sufficient to make a difference in the reflective power; and thus a shadow of the pattern on the back is reflected from the front surface. The correctness of this explanation is shown by the fact that in mirrors where the figures on the back are small and close together, the "magical" effect is not produced; the thin parts of the metal corresponding to the open part of the pattern not being large enough to spring back to any extent under the pressure.

A similar effect can sometimes be observed with the old-fashioned bright brass buttons, which were cast and polished like the Japanese mirrors. By reflecting the light from their front surface upon a piece of white paper, the letters on the back will appear in the reflected image.

METALLIC ALLOYS.

A recent lecture at the Royal Institution was by Mr. W. C. Roberts-Austen on the properties of certain alloys.

The lecturer began by speaking of the changes in the molecular state of bodies sometimes set up by very small causes, and he exhibited a warm basin painted inside with a saturated solution of platino-cyanide of magnesium. The bowl appeared to be warm and empty until he breathed into it, when it became of a crimson color, in consequence of the traces of moisture taken up by the salt from his breath; when he again warmed the bowl, to drive off the traces of moisture, the coating became once more colorless. Metallic tin, he said, will readily bend; but let it be alloyed with but a small proportion of arsenic, it becomes so brittle that a small bar

of it can be broken by the hand: this alloy closely resembles metallic zinc in its physical properties. An addition of but two-tenths or three-tenths per cent of tellurium to bismuth will alter the form of the crystals which the latter metal forms upon cooling from the melted state. Black and red sulphide of mercury are chemically the same, though differing so widely in appearance. Lead can be thrown down by electrolysis in such a condition that it will readily oxidize in air, and turn yellow; and copper can be so thrown down electrolytically as to present properties differing totally from those which it exhibits under ordinary conditions. Sulphur and phosphorus may, after melting, be cooled down below their melting-points without solidifying. He dropped a solid piece of phosphorus into some phosphorus so cooled down, and immediately the whole mass solidified. Somewhat the same phenomenon is presented by melted gold. He took some buttons of melted gold, allowed them to cool to a certain point, then touched them with a rod: the effect was, to momentarily raise their temperature, and make them glow; then they solidified. Joule, he said, had proved that, when iron is released from its amalgam with mercury, it will take fire on exposure to the air, and that several other metals behave in the same way.

Aluminum and mercury, he continued, have normally little affinity for oxygen. His demonstrator, Mr. A. Haddon, here took a plate of aluminum, placed it in a dish, and began to rub mercury over it. After the lapse of several minutes, the surface amalgam of the two metals began to turn dead-white in the air; and on inverting the sheet, and tapping it, a small cloud of pure white clay fell from its surface. Next Mr. Roberts-Austen half filled a flask with powdered bismuth, lead, and tin, poured mercury upon the mixture, and placed the flask upon a wet board. As the powders dissolved in the mercury, sufficient cold was produced to freeze the flask to the board. Mr. Spring of Liege had attempted to explain this phenomenon on the hypothesis that the metallic molecules so rearranged themselves as to occupy more space than before, and the act of expansion of the mass produced the low temperature.

The speaker next drew attention to a new alloy of platinum and gold upon which he had been working for some time. When thrown into water, it took fire; and the gold is released as a black powder, differing from ordinary gold in its properties, for it readily forms auric hydride. By heating, it turns into a dull-yellow powder, and by additional heating, forms normal metallic gold. The Japanese, he said, had long utilized this abnormal form of gold, which they obtained from its alloy with copper, with which latter they formed ornamental metallic designs upon knife-handles and such things, and then released the dark-colored gold by a pickling process; by its means they had produced an appearance of transparency in a metallic representation of water, at a place where in the design a duck was represented plunging half its body below the surface of a stream. He believed that no other nation had made use of this alloy.

The changes which small proportions of foreign matter will produce in metals are not necessarily of small practical importance, for a small fraction of bismuth in copper will reduce its electrical conductivity sufficiently to cause any submarine cable made with it to become a commercial failure. A cable made of the copper of to-day has twice as much message-carrying power as a cable made in the early days of telegraphy, because of the copper now used being purer. Pure gold has a breaking-strain of from sixteen to seventeen tons to the square inch; but when alloyed with but two-tenths per cent of lead, it will break with a slight blow or under a trifling strain. He next exhibited an alloy of zinc and rhodium which possessed in a small degree some of the properties of gun-cotton. — *Scientific American Supplement.*

FACTS ABOUT RAILROADS.

From an interesting little folder issued by the publishers of *Scribner's Magazine* we glean the following items. We may mention, in passing, that the special railroad articles now in course of publication in this magazine are of the greatest interest and value, and are a notable example of the highest class of modern magazine literature.

There are 150,600 miles of railroad in the United States, which is about half the mileage of the world. The total cost was $9,000,000,000, and over 1,000,000 persons are employed by them. The longest mileage operated by a single company is that of the Atchison, Topeka, and Santa Fe Railroad, about 8,000 miles. The Canadian Pacific extends from Quebec to the Pacific Ocean, and extends farther east and west than any other road. The largest number of passengers is carried by the New York Elevated Railroad, — 525,000 a day, or 191,625,000 every year; and of the passengers carried by all the roads in the country, only one in ten million is killed. The chances of being struck by lightning are much greater than of being killed by a railroad accident.

The longest single span of a bridge in this country is that of the new Poughkeepsie bridge over Hudson River, 548 feet; the highest bridge is the Kinzua viaduct on the Erie road, 305 feet; the longest tunnel is the Hoosac in Massachusetts, $4\frac{3}{4}$ miles; and the highest point reached by a railroad in the United States is 10,852 feet, or over 2 miles, at Marshall Pass, on the Denver and Rio Grande road.

The average cost of a mile of railroad is about $30,000. A sleeping-car is worth $15,000, or $17,000 if "vestibuled:" and a first-class engine costs $8,500; but, as an engine is capable of earning about $100 a day, it ought to pay a good interest on the investment. The first locomotive was built in this country by Peter Cooper of New York. With ordinary wear, a steel rail will last eighteen years; so that, practically, the entire railroad system of the world must be renewed six or seven times in a century.

The fastest time made by a train is a matter of much dispute; but it was probably accomplished on the Philadelphia and Reading Road, where 92 miles were traversed in 93 minutes, a single mile being run in 46 seconds, or at the rate of $77\frac{3}{4}$ miles per hour. The fastest long-distance time was made by a special theatrical train in June, 1886, between Jersey City and San Francisco, in 3 days 7 hours 39 minutes and 16 seconds.

We may also remark, in closing, that the service and accommodations on the American railroads are superior to any in the world, and that the average fares are much lower.

PROCURING CHEMICALS UNDER DIFFICULTIES.

In France the railroads and other private enterprises are "regulated" by the government to an extent which would surprise even an American legislator. The beauties of such a system are well illustrated by the following incident, related by a distinguished French practitioner in the *Gazette des Hopitaux:* —

"Some days ago, wishing to use the yellow, fuming, monohydrated nitric acid, I applied to my druggist for the same. He informed me that he had none. I then requested him to send for a small amount — ten grams — in a vial with a ground stopper. Yesterday he had not received the nitric acid, but, instead, the following note from the Pharmacie Centrale of France: —

"'According to the police regulations governing railroads, monohydrated nitric acid cannot be carried except in a special armor-plated car furnished by the sender; on this account your order cannot be filled.'

"Imagine my poor ten-gram vial of nitric acid in an armor-plated car!"

WORKSHOP HINTS.

To make Varnish Adhere to Metal.— Add five-hundredths of one per cent of boracic acid to the varnish.

Old Oil.— Oil seems to wear out by long-continued use, and to lose to some extent its lubricating qualities. It has been suggested, as a reason for this, that the minute spherical globules of which the oil is conceived to be made up, become flattened by the wear and pressure, and so do not slide and roll over each other as easily as before.

Simple Dead Finish.— For a simple but not very solid dead finish for walnut, proceed as follows: Take equal parts of burnt umber and finely ground pumice-stone; mix them together. Apply with a woollen rag or hair-cloth dipped in raw or boiled linseed oil. Clean with soft old cotton rags. The longer and harder the rubbing, the better the results. You need not fill or oil the walnut.

Delta-Metal. — An alloy of copper, zinc, and a small quantity of iron is called delta-metal. It possesses the properties of blacksmith's iron, is strong as steel, and of a golden-yellowish color. Toward acids and sea-water it is very resisting, and does not rust, nor does verdigris form on it.

Manhole Gaskets.— On opening a boiler, much trouble is often experienced from the tearing of the manhole gaskets. This may be avoided by putting a little white lead on the face of the gasket that rests on the manhole plate, and by chalking heavily the other face of the gasket, as also the part of the manhole frame with which it comes into contact. On subsequently opening the boiler, the gasket will generally be found to adhere firmly to the plate, and to separate from the frame without tearing.

To Clean Small Screws.— Screws that are too small for separate treatment may be cleaned from rust as follows: Take a pound of screws and place them in a small box — a cigar-box will do; put a small quantity of oil on them, and shake for a minute; then put a piece of cotton-waste in the box, and repeat for a minute; finally put a handful of sawdust in the box, and shake for another minute or so, and remove the sawdust by sifting it from the screws in a fine sieve.

Iron Cement. — The cement known as "iron cement" is required to withstand a high temperature, and act as a good conductor of heat, while making a sound joint. Mr. P. J. Grouvelle of Paris has patented a new kind of iron cement, in which a better conductor of heat is substituted for a portion of the cast-iron filings in the usual mixtures. A suitable mixture, he tells us, may contain sixty-two parts of cast-iron filings, thirty-two parts of gun-metal or copper filings, and six parts of a four per cent solution of glacial acetic acid, with sufficient water to render the mixture moist.

Cherry Stain. — Mix together, by stirring, one quart of spirits of turpentine, one pint of japan, one pound of Venetian red ground in oil, and two ounces of dry burnt umber. Apply with a brush, and wipe off with a cloth. Finish with one coat of shellac and two coats of varnish.

Home, Farm, and Garden.

A TENT OF LIVING VINES.

An article in a recent number of *St. Nicholas* shows how a very pretty tent can be made, which, instead of being formed of the usual canvas, has its sides composed of running vines, making a cool and refreshing retreat from the heat of the summer's sun. The plan

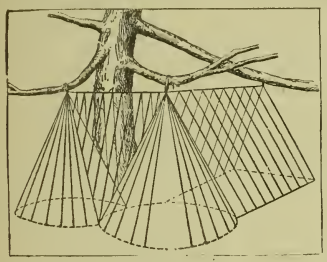

Fig. 1.

of construction is shown in Fig. 1. A tree with low-spreading branches is selected, and stout cords attached to them at three different places. To these cords smaller strings are attached, brought down to the ground, as shown in the plan, and secured to pegs driven into the earth. Any suitable plants, such as hops, peas, beans, or morning-glories, are then planted at the foot of the strings, and in due time they will be entirely covered with foliage.

The size and shape of the tent may, of course, be varied at pleasure. The circular parts are laid out by first suspending a stone from the branch above by a string reaching nearly to the ground. This improvised plumb-line will mark the centre of the circle. Then drive a peg into the ground at this point, and attach a string to it of a length equal to one-half the

Fig. 2.

diameter of the desired circle. By tying a nail or sharp-pointed stick to the other end, and moving the whole around the centre peg, a very accurate circle can be readily marked out on the ground, and the strings brought down to it from above, as before.

As the weight of such a mass of growing vines is very considerable, care should be taken to have the cords strong and firmly fastened, or the whole affair will be likely to collapse in a strong wind.

SELECTED RECIPES.

Tomato Fritters. — Bake some tomatoes, but not too much; add some parmesan cheese and a very little finely chopped shallot. Add as much cream and the white of an egg as will make the preparation of the consistency of batter. Drop this batter into a frying-pan of boiling butter; and, when the fritters rise, take them out and send to table, first dusting them over with grated parmesan cheese.

Iced Tomatoes. — Scald the tomatoes for a minute or so, and peel carefully; cut out the stalks with a sharp knife; remove about one teaspoonful of the contents, and put in a pinch of salt, sugar, and pepper, and as much minced parsley, shallot, and tarragon as will fill the space. Boil (that is, reduce) some cream with an onion and some salt until quite thick, put a dessertspoonful under each tomato, ice the whole, and serve in the dish it is dressed in.

Stuffed Tomatoes a la Milanese. — Take six ripe tomatoes of equal size, cut a circle off the top of each, and scoop out the insides. Press the pulp through a sieve, and mix in with it a little salt, cayenne, two ounces of butter broken into little pieces, two tablespoonfuls of bread-crumbs, a large shallot finely minced, a teaspoonful of parsley, and two very large tablespoonfuls of grated parmesan. Fill the tomatoes with this mixture, put on the tops again, and bake in a moderate oven, or fry them in oil till cooked brown; put mushroom sauce or sauce espagnole round them.

Savory Codfish Patties. — Have puff paste cases; spread anchovy butter all round inside, then put in some dried codfish cut up finely, and place on the top a cheese soufflé mixture. Place in the oven, and serve quickly.

Savory Fish-Balls. — Take some dried codfish; pound in a mortar with some butter and a little pepper; when quite smooth make into small round balls; roll them in beaten egg, and then have ready some very finely powdered parsley, some finely powdered lobster coral, some yolk of egg hard-boiled and passed through a sieve, and some hard white of egg also; roll some of the balls in the coral, some in the parsley, some in the white, and some in the yolk; arrange them in a pyramid, assorting their colors tastefully.

Potatoes a la Milanese. — Take as many potatoes as are required; choose the largest; bake them well, cut off the tops, and scoop out the insides. Pass the potato through a sieve, and add a tablespoonful of grated parmesan and gruyère cheese mixed, pepper, and salt; melt a good tablespoonful of butter (or more according to the number of potatoes) in a stewpan; put in the potato, and make it hot, and fill the skins of the potatoes with it; put them in the oven, and serve up very hot.

Potato Farci. — Cut large potatoes into halves. Scoop out the centres, leaving enough of the potato with the skin to form a case or cup. Mince cold cooked meat; add to it salt, pepper, and a palatable amount of butter; put it in these potato-cups, brush over the top with beaten egg, and bake in a moderate oven until the potatoes are done. The portions scooped out may be used for mashed potatoes or potato croquettes. These, if nicely made, are very palatable.

Lobster Cutlets. — This is one of the nicest ways of preparing canned lobster: —

Cut two cups of lobster rather fine; this is best done with a sharp silver knife, as steel is apt to destroy the flavor of the lobster. Put a half-pint milk on to boil in a small saucepan. Rub together one large tablespoonful of butter and three rounding tablespoonfuls of flour; then stir it into the boiling milk, and stir continually until it forms a thick paste. Beat until smooth, then add the yolks of two eggs; cook over the fire one minute, then remove, and add the lobster, a quarter of a grated nutmeg, a tablespoonful of chopped parsley, ten drops of onion-juice, salt and pepper to taste. Mix carefully without stirring, and turn out on a dish to cool. When cold, form into cutlets; roll first in beaten egg, and then in bread-crumbs, and fry in smoking-hot oil, dripping, or lard. This will take about two minutes. When done, drain; arrange them on a hot plate, and put a quilling of paper in the small end of each cutlet. Serve with cream sauce or sauce tartare.

Lobster Croquettes. — To every two cups of chopped lobster allow a half-pint of milk, two ounces of butter, and two rounding tablespoonfuls of flour. Put the milk on to boil. Rub the butter and flour to a smooth paste, and then add it to the boiling milk; stir until smooth and very thick, then add the yolks of two unbeaten eggs; cook one minute longer, and take from the fire. Add the lobster, a tablespoonful of chopped parsley, ten drops of onion-juice, a quarter of a nutmeg grated, and a palatable seasoning of salt and pepper; mix and carefully stir in the lobster; stand away to cool. When cold, form into cone-shaped croquettes. Dip in beaten egg and then in bread-crumbs, and fry in smoking-hot fat. Put a small claw in the top as a garnish. — From the *Practical Confectioner* and *Table Talk*.

HOW TO BLANCH CELERY.

The operation of blanching is one of the principal parts of growing good celery. Even large, well-grown celery, if it be not well blanched, looks very inferior; and, if it sells at all, it is usually at a very low price.

In no other part of this country, except in the far South, is celery grown as early, and of such good quality, as in Kalamazoo, Mich. We think, however, that it is useless for any person to try and grow early market celery unless he has the right kind of soil. If grown on high ground, the early crop will nearly all run to seed.

Some gardeners commence hilling celery nearly as soon as it commences to grow, while here we wait until the plant has attained nearly its full growth. We look more to the thickness of the celery than the length, which later develops as soon as hilled, but increases in thickness very little.

We have two methods of blanching celery, — one being by ground, and the other with boards. We prefer at all times to hill with ground when the weather will permit; but when it is too hot, we use boards.

Ground-Blanching. — When two crops are raised, nearly all the work of hilling has to be done by hand. If one crop is grown, the soil can be thrown toward the rows with the plough, thus greatly reducing the labor. A large hoe is used, about twelve inches in length. With this the soil is drawn lightly against the celery. No dirt is allowed to fall in the heart of the plant.

About five days after, and after it begins to blanch a little, the muck should further be put up against the celery with a hoe. If it cannot be done with a hoe, a spade or shovel must be used. This second hilling should be about six inches higher, or almost to the leaves of the celery. The bank at the bottom should be broad, so that, when

the soil is drawn up, it will not easily roll or wash down. After three days, loose ground should be taken from the sides of the rows, and gently pressed against the celery to the height of two inches. In doing this, great care should be taken, if the weather is warm, not to get it too tight, or it will rust. This finishes the process of banking with ground. It will blanch in from ten to fifteen days from the first hilling for the good Golden Dwarf variety, but others take longer.

Board-Blanching. — This method, it is claimed, originated in Kalamazoo a number of years ago, and has been in use continuously since. It requires two men to blanch with boards. The boards should be from ten to twelve inches wide, — according to the height of the celery, — one inch thick, twelve to sixteen feet long, and free from knot-holes, which would admit the air. On the ends of the rows the space between the boards should be filled out with grass or soil; otherwise, the first few stalks would not be blanched.

The boards are first distributed along the row, and laid flat on the ground on both sides, the edges against the bottom of the plants. The men straddle a row at each end of a board. The boards are raised by the outer edges, and both feet planted against them; the leaves are straightened up, without breaking, and the boards pressed against them. They are then fastened at the top with a small piece of wood which is eight inches long and two wide. In this two notches are sawed to the depth of one and a quarter inches and two and a half inches apart, which will leave the boards two and a half inches apart, which is the right distance on fair-sized celery. About four of these pieces should be used on a sixteen-foot board. If the celery is small, the boards should be somewhat closer. Heavy pieces of wire may be used instead of wooden pieces. When the row is completed, the earth should be drawn against the bottom of the boards, to keep them firm against the celery. This completes the work, and the crop will now take ten to fifteen days in blanching. — J. R. Van Bochove, *in Popular Gardening.*

THE LUXURY OF A ROSE-JAR.

A delightful perfume for halls and parlors in dwelling-houses or hotels can be easily procured at this season of the year, and it is such a pure yet delicious odor that it charms every one. It is simply a rose-jar, which should be opened for about one hour every morning, and then carefully closed. A writer in one of our English contemporaries describes the best method for stocking the jar, and, in doing it, suggests that the preparation of the rose-stock should be detailed to the care-taking member of the family, who never forgets any thing. Gather the rose-petals in the morning; let them stand in a cool place; toss them up lightly for one hour to dry, then put them in layers, with salt sprinkled over each layer, in a large covered dish, — a glass butter-dish is a convenient receptacle. You can add to this for several mornings, till you have enough stock, — from one pint to a quart, according to the size of the jar; stir every morning, and let the whole stand for ten days. Then transfer it to a glass fruit-jar in the bottom of which you have placed two ounces of allspice coarsely ground, and as much stick cinnamon broken coarsely. This may now stand for six weeks, closely covered, when it is ready for the permanent jar, which may be as pretty as your ingenuity can devise or your means purchase. Those with double covers are the best; and very pretty ones in the blue-and-white Japanese ware, holding over a quart, can be bought for a few shillings.

Have ready one ounce each of cloves, allspice, cinnamon, and mace, all ground (not fine); one ounce of orris-root, bruised and shredded; two ounces of lavender-flowers; and a small quantity of any other sweet-scented dried flowers or herbs. Mix together, and put into the jar in alternate layers with the rose-stock and a few drops of oil of rose, geranium, or violet, and pour over the whole one-quarter pint of good cologne. This will last for years, though from time to time you may add a little lavender or orange-flower water, or any nice perfume, and some seasons a few fresh rose-petals. You will derive a satisfaction from the labor only to be estimated by the happy owners of similar jars. — *Scientific American.*

HOW TO CLEANSE CHAMOIS.

The *Jewellers' Circular* gives the following process for cleaning soiled chamois: Make a weak solution of soda and warm water; rub plenty of soft soap into the leather, and allow it to remain in soak for two hours, then rub it well until quite clean. Afterward rinse it well in a weak solution composed of warm water, soda, and yellow soap. It must not be rinsed in water finally, for then it would be so hard, when dry, as to be unfit for use. It is the small quantity of soap left in the leather that allows the finer particles of the leather to separate, and become soft like silk. After rinsing, wring well in a rough towel, and dry quickly then pull it about and brush it well, and it will become softer and better than most new leather. In using a rough leather to touch up too highly polished surfaces, it is frequently observed to scratch the work. This is caused by particles of dust, and even hard rouge, that are left in the leather; and, if removed by a clean brush containing rouge, it will give the brightest and best finish.

TO KEEP A ROOM COOL.

A correspondent of the *London Carpenter and Builder* gives a very useful hint as to how to make a room tolerably cool during hot weather. The great cause of heat in a room is, of course, the glass, which, under the sun's rays, will become too hot to bear pressing with the fingers. It is shown that those who cannot enjoy the luxury of an outside sun-blind can extemporize a very good substitute by simply lowering the upper half of the window-frame, and turning the curtain outside. This not only screens the window, but creates a strong draught between the panes and the linen, and thus absolutely makes the glass cold. If there is any wind, the blind can be kept steady by drawing in the cord and tassel, and shutting the lower half of the window-frame tight down upon it.

HOUSEHOLD HINTS.

Whiting, dry or wet, gives glass a rich polish.

Use bits of wet paper on the carpet when sweeping.

A Handy Furniture Polish. — Make a mixture of olive oil one part, and vinegar two parts. Apply it to the furniture with a Canton-flannel cloth. Rub dry with another cloth of the same material. A housekeeper who uses this polish on the finest varnished furniture says it has no equal.

Watering Plants. — Persons whose plants mysteriously sicken and die are warned by Dr. J. W. L. Thudicum, in a communication to the London Society of Arts, that only pure water must be used in watering them. Impure water breeds a sort of fungus at the roots, which soon destroys them.

Filling Perfume-Jars. — A jar which holds a pound needs one grain of musk in it, no matter what else it may contain. Spices which have been passed once through a mill are better than those finely ground, and the ground orris-root is better than the powdered. English damask-rose petals are better than any others, and cheaper also, if you know the right place to buy them. When you have apparently filled your jar, remember that you can sift in about half as much salt as it would hold when empty, and that the salt is essential if you mean ever to moisten the fragrant compound.

Cleaning Brass — It is a great mistake to clean brass with acid. It very soon becomes dull after such treatment. Sweet oil and putty powder, followed by soap and water, is one of the best mediums for brightening brass or copper.

Window Plants. — Let us suppose you have but one window for plants, and that one of ordinary size. You cannot accommodate more than six average-sized plants without crowding them, and plants should never be massed together in such a way that each one loses its individuality. Have fewer plants, and give those you have a chance to develop themselves on all sides, by allowing them sufficient room. You can have a bracket on each side of the window for ivies, or some other climbing plant, and in the window you can hang a basket. In this way you can have nine plants in one window, and there will be ample room for all of them. Of course, if your plants be small, you can accommodate more.

GLEANINGS.

The Largest Flower. — The largest known flower is the Rafflesia, a native of Sumatra. It measures three feet in diameter, weighs fifteen pounds, and has a calyx holding six quarts. The odor is offensive.

Distillery-Fed Cattle. — The Mayor of Chicago has ordered all the cattle removed from the distilleries. The owners of two distilleries have complied, nearly three thousand head of cattle having been removed; the others refuse, and propose to fight the question in the courts. Meanwhile the milk is sold regularly.

The Time to Prune Vines. — Professor H. Muller, an eminent botanist, says that the best time to prune vines is while the grapes are ripening, and that the young shoots should be selected for this purpose, as they require for their development a large quantity of sugar, to the detriment of the ripening fruit.

Imported Weeds. — Of eighty-six species of weeds described by Mr. L. H. Pammel of St. Louis as growing in South-western Wisconsin and South-eastern Missouri, forty-six are of European and thirty of American origin. One-third of the latter class, and nearly one-fourth of the entire list, are composites.

Green Food in Winter. — Many poultry-keepers rely largely upon cabbage for green food for their fowls during the winter season, but of late years some have practised laying in a supply of green frozen rye with excellent success. The ground should be made very rich, so as to insure a rank, rapid growth; and the rye should be sown much thicker and earlier than where a crop of grain is desired. When the soil is rich, and the grain sown in August, it will reach a growth of from sixteen to twenty inches before the ground freezes. It should remain in the field until just before snow comes.

Soil for Pot-Plants should be carefully prepared always. For this there is no better foundation than well-decayed turf that is full of root fibres. Many plants would need nothing more; strong feeders should have manure added. Perhaps the soil that will best suit the majority is two parts decayed turf to one part of well-rotted manure.

The Popular Science News.

BOSTON, AUGUST 1, 1888.

AUSTIN P. NICHOLS, S.B. . . . . *Editor*
WILLIAM J. ROLFE, LITT.D. . . . . *Associate Editor*

The date of Aug. 22, for the meeting of the American Association for the Advancement of Science at Cleveland, has been changed by the local committee to the 15th, on account of another great gathering to take place there that week. The special office and reception-rooms of the Association will be at No. 407 Superior Street, next door to the Hollenden, where will be the hotel headquarters. The meetings will be held at the Central High School building, on Wilson Avenue, where will be the offices of the local committee and of the permanent secretary during the week of the meeting.

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The use of electric motors as a substitute for the steam-engine is rapidly increasing. In cities which are provided with an electric-lighting plant, the dynamos can be used during the day to furnish a current for operating motors in workshops and small factories at a less expense than that of a steam-engine. In an adjoining city a large printing-office has recently dispensed with a seven-horse power engine and boiler, and substituted a Thomson-Houston motor, which gives perfect satisfaction, and is found to be less expensive than the coal, water, and engineer's wages which the engine required. In addition, it is always ready for work night and day, and can be started up at any time to fill an urgent or unexpected order. While the steam-engine would be more economical for heavy work or a large manufactory, the advantages of electricity as a source of power for small establishments is undeniable; and it will undoubtedly come into general use.

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A case of "mind-healing" in a suburban city has lately attracted much attention, inasmuch as it resulted in the death of a mother and infant. A relative who had charge of the patient refused to call in medical assistance at the critical period, but relied upon the power of the will, with the fatal result above noted. At the inquest it was proved that with ordinary care the life of both mother and child might have been saved. The "mind-healer" was arrested, tried for manslaughter — and acquitted. We suppose that the motives of a jury are past all finding out; but it is evident that the criminally foolish woman was tried by "a jury of her peers," or else a proper punishment would have been awarded for her neglect of the most ordinary precautions at a time when the best of care and medical skill are pre-eminently necessary.

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The scientific knowledge of Congress was recently illustrated in a bill which it passed, appropriating a hundred and fifty thousand dollars for the building of an air-ship. This "air-ship" was to be an immense chamber or balloon of steel, from which the air was to be exhausted, so that it should be buoyed up by a force equal to the weight of the air removed. Theoretically the scheme was correct; but the evident impossibility of making such a steel vessel of a sufficient strength to sustain the pressure of the atmosphere, — fifteen pounds to the square inch, — and sufficiently light to float in the air, did not occur to the lawgivers of the nation. Fortunately the bill did not pass to its final stage, and will probably never be heard of again, as a patent was refused the inventor, for the reasons above mentioned.

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The story of the substitution of a rabbit's eye in place of a diseased human optic has been going the rounds of the papers once more, and deserves correction. The facts were simply, that a piece of the cornea, or transparent portion, of a rabbit's eye was grafted upon the cornea of a human eye, and actually continued to live, and form a part of it. The operation was a remarkable one, and did not need the absurd and sensational additions with which the newspaper reporters embellished their accounts of it.

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A law has recently been enacted by the State of New York providing for the infliction of the death penalty by electricity. This is a most commendable reform, which we hope to see adopted by other States. The method of execution by hanging is clumsy, barbarous, and uncertain; and the only possible excuse for its continuance — the effect upon the criminally-minded — is, we think, a mistaken idea. The quiet and mysterious action of the electric current would make even more impression upon the ignorant than the familiar rope and scaffold.

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Professor C. E. Monroe of the United States Naval Academy finds (*American Journal of Science*) that when a disk of gun-cotton is exploded upon an iron beam, the markings produced by the explosion indicate the development of successive waves of energy during the continuance of the explosion. The observation is a most interesting one, and is to be more thoroughly investigated.

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THE FUTURE OF CHEMISTRY.

In reviewing the progress of chemistry during the last hundred years, the advance is perhaps more evident than in any other branch of science. Founded as chemistry is upon the qualities and relations of matter, and dealing with the phenomena of the reactions of its different forms, — phenomena which are complicated and mysterious to the highest degree, — it requires, for their proper observation and interpretation, elaborate and costly apparatus, as well as an observer with exceptional mental ability. We may smile at the crude ideas of phlogiston, "fixed" or "vital air," etc., of the last century, but they were an honest attempt on the part of the earlier chemists to formulate the facts observed by them into a definite theory; and, with the crude and clumsy appliances at their command, it is greatly to their credit that their errors were so few in number. What modern chemist would be willing to undertake an investigation of the nature and properties of an unknown gas, for instance, unprovided with a chemical balance or the modern forms of glass and platinum apparatus? Most modern kitchens would supply a better assortment of utensils for such work than could be found in the laboratories of Priestley, Cavendish, Scheele, or Lavoisier: but the phenomena were observed and recorded by them with remarkable accuracy; and although their theories of their cause were defective, they were none the less the foundation on which the present science is based.

The modern chemical philosophy is based upon a mass of observations and investigations by chemists in all parts of the world, requiring an amount of labor and perseverance of which few persons have any conception. Two discoveries stand out prominently above the rest, — that of the nature of combustion by Lavoisier, and the idea of atomic weights or combining numbers, first determined by Dalton. But these would have been of but little importance without the additional and confirmatory work accomplished by the host of patient workers whose names have remained comparatively unknown.

What has been accomplished by chemistry in the past is well known, and it is a record of which all chemists may well be proud. A rational and comprehensive theory of matter and its laws has been evolved, and the practical applications of the science have affected every branch of industry. Nor do we see any reason why the coming century should not show still greater progress. On the side of theory there is the promise of a rich field for discovery hitherto unworked in investigating the true nature of the so-called elements, and the remarkable connection between their atomic weights and their chemical and physical properties. The more this subject is studied, the more probable it seems, that, if all forms of matter are not different varieties of one primitive substance, at least the elementary bodies are much more closely connected with each other than has hitherto been considered possible. No one can examine those wonderful diagrams showing the gradual changes in the properties of the elementary bodies with the increasing atomic weight, without feeling that one of the sublimest mysteries of the universe is on the point of being revealed. The fortunate student who first finds the key to the mystery, and solves this modern riddle of the Sphinx, will do for chemistry what Darwin has done for biology, and show that the great law of evolution applies to inorganic as well as organized living matter.

Innumerable other problems are still waiting solution, — the actual cause of isomerism, allotropism, and dimorphism: the forces which produce crystallization; and the con-

nection between the physical and chemical properties of different substances. In the department of organic chemistry, or the chemistry of the hydrocarbon compounds, the work to be accomplished which is already in view is almost endless. In these numerous substances made up of carbon, hydrogen, and oxygen, we have the most diverse properties depending apparently upon the smallest possible variation in composition, or even in those made up of the same kind and number of constituent atoms. In organic substances the actual composition seems to count for very little, while the wide difference between different hydrocarbons apparently depends upon some other cause, which, for want of a better explanation, we call the relative position of the atoms of which the molecule is built up. While this theory perfectly explains the observed facts, it is, on the whole, a not very satisfactory one; and to discover the actual property or attribute of the substances carbon, hydrogen, and oxygen which causes them to combine into the innumerable and widely differing bodies already known to us, is a problem of equal importance with that of the nature of the elements themselves.

Turning to the practical side of the question, the opportunities for the application of chemistry to the advancement of the arts are very numerous. The artificial manufacture of natural products will doubtless be greatly extended. Already the brilliant coloring-matter of the madder-plant is made artificially in immense quantities, and the magnificent blue of the precious lapis-lazuli is exactly copied in the common ultramarine; coal-tar furnishes a substitute for sugar in the well-known saccharin; while indigo, glucose, certain alkaloids of the quinine group, and many other valuable substances, have been directly formed from their elements, although as yet at a cost which prevents the practical application of the methods. It is not too much to hope that processes of manufacture may be discovered by which such substances as morphine, quinine, indigo, etc., can be produced at a cost much below the present.

The utilization of waste products is an economical problem not to be overlooked, and the destruction or purification of sewage is also of the highest importance. Substances possessing new and unusual properties are constantly needed in the arts, and the chemist will find a remunerative employment in supplying this need. Perhaps the most important discovery of all, however, would be a means for converting the energy stored up in coal, directly into electricity without waste. If this is ever done, it will produce a greater industrial revolution than the introduction of the steam-engine. Light, heat, and power could be produced at a much smaller cost than at present, and distributed in any direction. Although we can see no way at present by which this result can be attained, it is not impossible, and may become a fact before another hundred years has passed away.

The progress of chemistry has been very great; but it is not a progress towards a journey's end, but into an ever-widening field for discovery which gives a promise of an even more brilliant future.

PRECIPITATION.

If we dissolve some ordinary washing or cooking soda in water, and add it to lime-water, the mixture will become turbid, and a white opaque powder will be formed, which will finally subside to the bottom of the vessel. This phenomenon is known as precipitation, and always occurs when a substance in solution is from any cause rendered insoluble.

In the experiment above referred to, two substances, hydrate of lime and carbonate of soda, both of which are soluble in water, were mixed together, when a chemical change took place by which the acids and bases changed places with each other, forming hydrate of soda and carbonate of lime. Carbonate of lime, however, is quite insoluble in water, and therefore separates or is precipitated out of the solution.

This process of precipitation is of the utmost importance to the chemist, and is the chief means by which, in the analysis of unknown substances, he separates out the different constituents. Nearly every element can be precipitated by some reagent; and the appearance of the different precipitates is in many cases so characteristic, that the nature of the substance under examination is at once evident.

Suppose, for instance, that we have a clear liquid containing salts of some unknown metals in solution. We first add a quantity of hydrochloric acid, and a copious white precipitate is at once formed. This may indicate the presence of either lead, mercury, or silver; and it is necessary to still further separate the constituents. We filter and wash the precipitate, and then boil a part of it with water. The hot water dissolves the chloride of lead, which crystallizes out on cooling; or we may add a little dilute sulphuric acid, which again precipitates the lead in the form of a sulphate.

Upon the remainder of the precipitate upon the filter we pour strong ammonia. If it turns black, mercury is present. If it also contains chloride of silver, this will dissolve in the ammonia, and pass through the filter; and by carefully neutralizing the ammonia with dilute nitric acid, the chloride of silver is again precipitated by itself, and can be collected and weighed if necessary. In the same manner all the different elements can be separated from each other by appropriate reagents, their presence detected, and their amount determined.

The appearance of precipitates varies very greatly. The carbonate of lime mentioned above is a light white powder. Sulphates of lead or barium are very heavy and dense white powders. Hydrate of iron precipitates as a slimy brown mass, which, upon boiling, becomes of a more granular nature. Hydrate of alumina is flocculent, like cotton-wool; while the ammonio-phosphate of magnesia is precipitated in minute crystals, and more abundantly in the places where the sides of the vessel containing it have been rubbed with a stirring rod. Phosphate of manganese is a gelatinous mass, but, upon boiling, is changed into minute scales of a pearly lustre, which can be filtered and washed with the greatest ease. Gold, silver, and platinum can be precipitated in the metallic state as black powders of inconceivable fineness, or when separated by a current of electricity, as in electroplating, show their usual metallic characteristics. Chloride of silver resembles curds of milk, and, in addition, turns black in the sunlight.

The colors of precipitates are very varied and characteristic. Sulphide of iron and most of the metallic sulphides are black; sulphide of arsenic, however, is of a bright yellow, and sulphide of antimony a vivid orange; hydrate of chromium is green, and ferrocyanide of iron a magnificent blue (Prussian blue). A compound of gold and tin is the beautiful purple of Cassius. Iodide of mercury, when first precipitated, is of a yellow color, but in a few minutes changes spontaneously to a brilliant scarlet; a change of crystalline form occurring at the same time.

Precipitation may also occur from a change in the nature of the solvent as well as that of the substance in solution. We have seen how the chloride of silver is precipitated from its solution in ammonia when the latter is neutralized with an acid. By diluting a solution of resin in alcohol with sufficient water, the alcohol may be so weakened that the resin is precipitated, and the liquid becomes cloudy and opalescent. A few drops of cologne, which is an alcoholic solution of various perfumes, poured into a glass of water, will illustrate this very clearly. Chlorides of antimony and bismuth in strong acid solutions are also decomposed by dilution with water, basic salts being precipitated.

Potassium and sodium are precipitated with difficulty, as nearly all their compounds are soluble. A chloride of platinum and potassium is, however, insoluble in alcohol; and a complex salt of antimony, tartaric acid, and sodium is not very soluble. Sodium, however, is rarely precipitated in the course of an analysis, but is usually separated and determined by other methods.

To the chemist nothing can be more interesting than the appearance of the different precipitates as the result of his mixing of different solutions. The appearance of a slight turbidity in a clear solution may be an indication of a discovery of the utmost importance. We are still unable, however, to answer the question as to why precipitation takes place. We do not know why hydrate of lime is soluble in water, and carbonate of lime insoluble; and that quality of matter which renders it soluble or insoluble must be left for future experimenters to discover.

Paper Houses. — At Parkersburg, Penn., two houses are being erected, which will have paper walls, paper partitions, and paper roofs.

A FOSSIL HUMAN FOOTPRINT.

In various localities, notably upon the rocks of the Connecticut valley, there have been found the footprints of various animals belonging to former geological periods, which have been preserved by the hardening of the soft sand or mud into solid rock. There have lately been discovered in Nicaragua certain human footprints which have been preserved in the same manner, although of much later date than those referred to above. They have been described at length by Dr. Daniel Brinton; and four of them have been removed to the Peabody Museum of Archæology at Cambridge, Mass., where they are now on exhibition.

These footprints occur on the borders of a lake near the town of Managua, at a depth of twenty-one feet below the surface. Several different strata of limestone, calcareous tufa,

sand, clay, and volcanic ashes were found above them, indicating an unusual activity of geological forces. The whole region is of a volcanic nature, and in former years eruptions and changes of level were much more frequent than at present.

The footprint represented in the illustration is about ten inches long, and from three to four and a half inches wide. The excessive width in proportion to the length is doubtless due to the soft earth spreading under the weight. The great-toe is large and prominent, and is longer than the second one. This peculiarity is considered by some archæologists to be a sign of inferiority of race. The fore part of the foot has made the deepest impression, showing it to be made by a vigorous and strong-gaited person.

The age of these footprints is very uncertain. In a region where the natural forces are so active, the condition of the superficial strata is of little use as a measurer of time. Certain fossils accompanying the footprints have been referred to the quarternary era, and the bones of a mastodon were found in a layer of earth above the footprints. This, however, would not indicate a very great antiquity, as that animal is supposed to have lived there in quite modern times. A skeleton has recently been found in an artificial fish-pond near Concordia, in Columbia, Central America. The country surrounding the Lake Nicaragua is rich in relics of prehistoric inhabitants, who were evidently a distinct race from those inhabiting the country at the time of the Spanish conquest; and although it is at present impossible to set a date for these literal "footprints on the sands of time," there can be no doubt that they are of great antiquity, and may even date back to that remote period when the northern part of the country was covered with the snow and ice of the glacial epoch.

THE PEOPLE AND THE SCHOOLS.

In a recent communication to *Science*, Mr. Edward H. Boyer, a principal of one of the New York grammar-schools, has done a good service in placing the responsibility for the over-pressure and excessive work imposed upon their pupils upon those most directly to blame, — the parents themselves. There is too much shifting of responsibility in this matter. The teachers claim, and with some reason, that they must complete the courses assigned by the school committee, and the school committee are inclined to place the blame upon the Legislature in setting too high a standard for the public schools; but the fact remains, that not only in New York City, but in every city or large town in the country, the courses of study in the public schools are too numerous and too difficult for the average pupil to creditably complete without serious injury to his health. As Mr. Boyer says, it is only necessary for the people to demand a change, and that change will be immediately made.

The schools are to-day just what the people, through apathy, indifference, carelessness, and ignorance, have permitted them to become, — one vast machine; a treadmill, teachers treading the wheel, happy innocent children the grist, superintendents for task-masters, and the product a mass of automatons.

You, the people of New York City, are directly responsible for the larger part of all the evils that exist in the common-school system. Your children attend them; you hear from them daily reports of the manner in which they are educationally crammed; you see them at home, wearing out their young lives in preparing lessons for the next day's recitations: and, if some wise teacher reduces the tasks assigned for home-study, you immediately begin to inquire why your children have no more books, and why they have so few lessons to learn at home.

I know you do this, for I have heard you talk just that way. In vain have I pleaded with you for the little ones. In vain have I told you that five hours' daily attentiou to books, to recitations, to instruction, is all that any growing child can safely endure. "No, no!" you cry, "give them more lessons; give them tasks to do at home:" and your children go through their school-lives with the shadow of the coming task always falling upon the task just finished. The gentle, obedient, loving, and affectionate little ones suffer; while the dear bad boys won't even make an effort, and thrive accordingly. The teacher can sometimes go home with his work finished for the day: the pupil never.

Now, if I will not permit this wrong to be perpetrated in the school under my charge, you take your boy away, and send him to Mr. Examination Hunter's school; and you take your girl out of Miss Honest's department, and send her down to Miss Show-off's school; and then you point with parental pride to the great load of books your little ones stagger under, as a proof of the superior efficiency of those two principals, "whom we all respect." Then, when your little girl graduates, and Miss Show-off orders all the graduates to wear white dresses and tea-roses, and to come in carriages, and to drape their desks in white, you all say, "She has no right to give any such orders, and it ought to be stopped; and" — you get the dresses and the tea-roses and the carriage, and you attend the reception; and it is all so beautiful, and the members of the Mutual Admiration Society do speak so mellifluently, — buttered honey, as it were, — that you are as proud of your daughter as a drum-major on parade. And then you go home, and your daughter has typhoid-fever, or spinal meningitis, or some other Latin disease, and you lay the blame on Providence. Who is to blame if the supply of sham education be exactly proportioned to your demand for it?

If you could only once be roused from your apathy on this subject, do you not know that your servants — the Mayor, the Board of Education, and the Legislature of this great State of New York — would skip around like waiters in a dime restaurant to get you what you want?

The public schools of New York City will never be any better than the people of that city demand that they shall be.

[Specially reported for the *Popular Science News.*]

METEOROLOGY FOR JUNE, 1888.

TEMPERATURE.

Average Thermometer.		Lowest.	Highest.	Range.
At 7 A.M.	64.83°	54°	82°	28°
At 2 P.M.	76.33°	60°	93°	33°
At 9 P.M.	65.17°	55°	79°	24°
Whole month	68.78°	54°	93°	39°
Last eighteen Junes	66.80°	61.67°, in 1881.	70.01°, in 1876.	8.34°

The 28th was the coolest day of the month, with an average of 59⅔°. The 29th, 2d, and 3d days, near the close and beginning of the month, were but slightly warmer. The 23d was the hottest day, not only of the past month, but of the last twenty-four years, including the entire record of my observations. The heat on that day was so remarkable, that a more full report may seem desirable. The mercury did not, indeed, reach so high a point at any hour on that day as on several occasions in preceding years, as Aug. 3, 1865, July 14, 1868, and July 4, 1872, when it reached 96° and 95°, while the highest point on the 23d ult. was only 94°. But the peculiarity of this day was the continuance of extreme heat hour after hour. Even at 7 A.M. the mercury stood at 82°, also the highest point at that hour during the twenty-four years. At about 10 A.M. it had risen to 90°, and continued at 90° or above until 7 P.M., — an average of 92° for those continuous nine hours. It rose to 94° at 11 A.M., but soon fell to 93°, where it remained till 2 P.M. Soon after 7 P.M. a dark cloud appeared in the north, with sharp lightning, distant thunder, and a slight sprinkle of rain, reducing the temperature 12° in two hours, and leaving the mercury at only 78° at 9 P.M. The average for the fourteen hours, taken

hour by hour, was nearly 89°; though taken as usual, at 7, 2, and 9, it was only 84⅓. The 21st was a very uniformly cool day, with a range of only 2°, and average of 64⅔. The 22d rose rapidly, and the 24th sunk as rapidly to 62°, leaving the hot day near midway between two comparatively cool ones, — sudden changes, not easily accounted for. During the twenty-four years of my record now nearly completed, I find the thermometer has reached 90°, and upwards to 96°, fifty-eight times; only once to 96°, in 1865; twice, 95°; five times, 94°; seven times, 93°; twelve times, 92°; ten times, 91°; and twenty-one times, 90°. In five years it did not reach 90°. In one year (1866) it reached 90° to 94° ten times, four of which were consecutive.

SKY.

The face of the sky in 90 observations gave 48 fair, 23 cloudy, 15 overcast, and 4 rainy, — a percentage of 53.3 fair. The average per cent fair the last eighteen Junes has been 59.4, with extremes of 40.1, in 1872, and 75.5, in 1871. Only four Junes in the eighteen years have been more cloudy than the present.

PRECIPITATION.

The amount of rainfall the past month was only 1.71 inches, while the average for the last twenty Junes has been 2.75 inches, with extremes of 0, in 1873, and 5.10, in 1875. There was no rain till the 14th, when .73 inch fell, after which light rains followed, keeping vegetation in a thriving condition. The amount since Jan. 1 has been 28 51 inches, half the year; while the average for this period in twenty years has been only 24.62.

PRESSURE.

The average barometer the past month was 29 907 inches, with extremes of 29.68, on the 1st, and 30.15 on the 13th, — a range of .47 inch. The average for the last fifteen Junes has been 29.932, with extremes of 29.845, in 1882, and 30.056, in 1884. The sum of the daily variations the past month was 3.71 inches, giving an average daily movement of .127 inch; while this average the last fifteen Junes has been .118, with extremes of .058 and .218. The largest daily movements were .34, on the 30th, and .30, on the 11th. Six continuous mornings, from the 21st to the 26th, were stationary.

WINDS.

The direction of the wind in 90 observations gave 7 N., 0 S., 9 E., 22 W., 7 N.E., 19 N.W., 2 S.E., and 24 S.W., — an excess of 7 northerly and 47 westerly over the southerly and easterly, indicating the approximate average direction to have been W. 8° 28′ N. The westerly winds have uniformly prevailed over the easterly by an average of just 31 observations, and the southerly over the northerly, with four exceptions (including the present month), by an average of 11.58, indicating the general average direction in nineteen Junes to have been W. 20° 29′ S.; showing that the winds the present June have been nearly 29° more northerly than usual. The relative progressive distance travelled by the wind the past month was 47.52 units, and during the last nineteen Junes 628.8 such units, — an average of 33.10; showing less opposing winds the present June than usual.

In review, I may observe that the temperature of the first half of the year has been a trifle more than 1 degree (1.04°) below the average; but as this loss occurred chiefly in January (5.65°), when vegetation is stationary, the surplus of June (1.89°) has nearly overcome the deficiencies of April and May (3.07°), so that the season is now within three or four days of its usual forwardness.

D. W.

NATICK, *July* 6, 1888.

[Specially reported for the *Popular Science News* from the Observatory of the College of New Jersey.]

ASTRONOMICAL PHENOMENA FOR AUGUST, 1888.

THE Sun will be eclipsed on Aug. 7. It is only a partial eclipse, and is invisible in the United States. It is visible in the Arctic Ocean, Norway, and Sweden, portions of Denmark and Greenland, and the extreme northerly parts of North America and Asia.

The Planets. — Mercury is just moving away from western elongation, and may possibly be seen as a morning star during the first few days of the month. It comes to superior conjunction with the Sun on Aug. 23. Venus has now become an evening star, but remains quite close to the Sun during the month, being only about 14° distant on Aug. 31, — hardly far enough away to be easily seen. Mars is an evening star in the western sky, having passed quadrature in July. By the end of the month it sets about three hours after the Sun. It moves eastward about 20° during the month, through the eastern part of Virgo and into Libra. Jupiter is also in the western sky in the evening; at the beginning of the month it sets a little before midnight, and at the end of the month at about 10 o'clock. It is in quadrature with the Sun on the morning of Aug. 20, and moves slowly eastward and southward during the month. The following eclipses of his satellites are visible in the United States during the month. The phenomena all take place near the planet, on the upper right-hand quadrant, as seen in an inverting telescope. D denotes disappearance, R reappearance. Times are Eastern standard.

III. R. Aug. 7, 10h. 7m. P.M.	I. R. Aug. 9, 8h. 54m. P.M.
III. R. Aug. 7, 11h. 58m. P.M.	I. R. Aug. 16, 10h. 49m. P.M.
II. R. Aug. 9, 8h. 23m. P.M.	II. R. Aug. 16, 11h. 1m. P.M.

Saturn is in conjunction with the Sun on Aug. 1, and becomes a morning star. It cannot be seen until toward the end of the month, when it may be found in the morning twilight. Uranus is in Virgo, about 7° north and west of Spica. It sets early in the evening. Neptune is south of the Pleiades, and rises a little before midnight at the end of the month.

The Constellations. — The positions given hold good for latitudes differing not many degrees from 40° north, and for 10, 9, and 8 P.M. for the beginning, middle, and end of the month respectively.

Lyra is in the zenith, Aquila is coming to the meridian at about 60 altitude, and Sagittarius is low down on the south meridian. East of Sagittarius is Capricornus, at about the same altitude, with Piscis Australis just rising below it. Aquarius follows Capricornus, and Pisces is just rising in the east. Above Pisces are Pegasus and Cygnus, the latter near the zenith. Going from the eastern horizon toward the pole star, we find first Andromeda, and next Cassiopeia. Perseus is on the horizon below Cassiopeia, and Cepheus is above; the head of Draco is just west of the meridian, and a little north of the zenith; Ursa Minor is mainly to the left and above the pole, while Ursa Major is to the left below; Hercules is to the west of the zenith high up; and below it are Corona Borealis and Boötes, with Virgo just on the west horizon. Libra and Scorpius, with Mars and Jupiter, follow Virgo, and are both low down in the western sky. Ophiuchus is above Scorpius.

M.

PRINCETON, N.J., *July* 2, 1888.

SULPHURETTED HYDROGEN WATER can be kept for at least two months and a half, according to A. Schnerder, if it is preserved in a black glass-stoppered bottle, the stopper of which should be profusely greased with vaseline.

LITERARY NOTES.

The Social Influence of Christianity, with Special Reference to Contemporary Problems. By David J. Hill, LL.D. Price $1.25. Silver, Burdett & Co., publishers, Boston.

The leading views regarding the nature of society, both ancient and modern, are comprehensively stated, traced in their development, and intelligently criticised from a scientific, Christian, and American point of view. The central ideas of Christianity, which the author carefully distinguishes from the Church, are admirably defined, and their influence upon society historically studied. After this more general treatment, the social relation of Christianity, considered as the influence of Jesus Christ, is elaborated in a brief, clear, and conclusive manner with reference to the contemporary problems of Labor, Wealth, Marriage, Education, Legislation, and the Repression of Crime. No other American book approaches so near being a complete outline of sociology from a prevailingly ethical point of view. It cannot fail to attract attention as a well-planned and vigorously written work.

Three Introductory Lectures on the Science of Thought. By F. Max Müller. The Open Court Publishing Company, Chicago, Ill. Price 75 cents.

The book contains three essays: 1, The Simplicity of Language; 2, The Identity of Language and Thought; and 3, The Simplicity of Thought.

The Appendix consists of Max Müller's Correspondence on "Thought without Words" with Mr. George Romanes, the Duke of Argyll, etc.

Max Müller's essays must not only be read, they must be studied; and we should be very grateful that the eminent philologist uses such simple language. In spite of all the simplicity of Max Müller's style, it takes much careful study to fathom the depth of his thoughts.

The study of language is of interest to the lawyer as well as the clergyman, the scientist as well as the teacher; and no education is complete without it.

Civics for Young Americans; or, First Lessons in Government. By William M. Giffin, A.M. A. Lovell & Co., New York. Price 50 cents.

This most excellent and interesting description of our form of government is adapted for the use of young people, and shows in a very striking manner the different forms of government existing, and the peculiarities and advantages of that of the United States. It is impartial in its treatment of the subject, and free from partisan prejudices.

Chemical Problems. By J. P. Grabfield and P. S. Burns. D. C. Heath & Co., publishers, Boston.

This work contains numerous carefully prepared problems illustrating the different principles of chemical science. Each division is preceded by a brief description and explanation of the problems, and the principles involved in their solution. Teachers will find it a great help in conducting their classes. It also includes the annual examination-papers of the Massachusetts Institute of Technology.

Strang's *Exercises in English*, published by the same firm, is a collection of exercises for criticism and correction. Teachers of grammar, rhetoric, and syntax will find it a most useful work.

Part III. of the magnificent *Old and New Astronomy*, by Professor Richard Proctor, is issued by Longmans, Green & Co. of New York. We have before referred to this work, and need only say that the present number is even superior to the preceding ones. Every one interested in astronomy will find pleasure and profit in subscribing for the series of twelve.

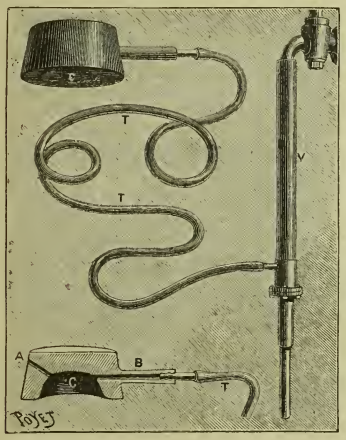
Dr. Ephraim Cutter of Broadway and 55th Street, New York, has published a partial list of the *Clinical Morphologies* of the fluids of the body, food, drinks, clothing, etc., which are of great interest and importance. Every physician and medical student should have a copy for reference.

Pamphlets, etc., received: *The Human Soul: its Origin and Analysis*, by W. J. Parker, M.D., Nashville, Tenn.; *A System of Easy Lettering*, by J. H. Cromwell (E. & F. N. Spon, publishers, New York); *Osteology of Porzana Carolina* and *The Sternum in the Solitary Sandpiper*, by R. W. Shufeldt, M.D.; *Cocaine Dosage, Addiction, and Toxæmia*, by J. B. Mattison, M.D., Brooklyn, N.Y.; *The Treatment of the Hair in relation to the Prevalence of Baldness*; *Crop Report for July* of the Georgia Agricultural Commissioner; *Analyses of Commereial Fertilizers* at the Massachusetts Agricultural College; *Catalogues of the Faculty of Medicine of the McGill University*, the *Albany Medical College*, and the *University of Nebraska*; also the *Annual and Quarterly Reports of the United States Bureau of Statistics*.

Medicine and Pharmacy.

PNEUMATIC MASSAGE.

A curious application of the air-pump, to which the water-pump described in the number of this paper for June, 1887, is particularly adapted, has been devised by Dr. Breuillard of France. It is intended as a substitute for the ordinary massage in producing a regular and continuous traction of the skin and subjacent tissues. The instruments consist of an elliptical piece of soft rubber, *C*, with a cavity hollowed out on the under side. This cavity has two small openings, *A* and *B;* the latter being prolonged into a tube which connects with a flexible rubber pipe, *T*. This is attached to an air-pump, *V*, which may be of any desired pattern, although the water-pump referred to above, which can be attached to any water faucet, and is continuous and automatic in



operation, is to be preferred, from its convenience and cheapness.

To operate the apparatus, the hollow piece of rubber — the *ventouse*, as Dr. Breuillard calls it — is pressed firmly against the body of the patient, and the air-pump started. When the opening *A* is closed by the finger, the skin is immediately drawn up by the atmospheric pressure. By removing the finger from *A*, the pressure is relieved, and the skin resumes its natural condition. The ventouse is to be moved over the body as the operator desires; and by replacing or removing the finger over the opening *A*, the flesh and skin may be manipulated to any extent, and in a much more regular and thorough manner than can be done by the hand. The proper amount of pressure to be applied varies in different cases, but the average vacuum should be equal to that of a column of mercury about eighteen inches high, or two-thirds of a perfect vacuum. A pressure gauge is unnecessary, as one soon learns by simple observation the proper amount of pressure to apply. The invention is certainly an ingenious one, and may prove to be of great usefulness in cases where a vigorous manipulation of the skin is indicated.

[Original in *Popular Science News.*]

ANTISEPTIC SURGERY.

BY JOHN CROWELL, M.D.

Modern operative surgery has undergone a complete revolution within the last decade. Surgeons who attained eminence in the palmy days of Mott, Gibson, and Muter would find with amazement, could they revisit their old arenas where they once held absolute sway, that their favorite methods and theories had been swept away by a new race of operators, with paraphernalia and manipulation involving the nicest care and discrimination.

The antiseptic methods now universally accepted by the profession are the results of the Listerian investigations; and the changes wrought by the adoption of these principles are full of practical interest to all classes, professional and non-professional For whatever tends to prolong life and relieve suffering, whatever helps man in his struggle against disease and in his efforts to restore the wasted energies of the system, becomes of universal importance in the great conserving movements of the human economy.

Antiseptic surgery is simply based upon a correct observation of a common biological process, — the decomposition of organic substances. Prevention of putrefaction has been practised for ages, and it is only by applying this principle to the treatment of accidental and surgical wounds that the simple story of sepsis and antisepsis is unfolded.

As a direct sequence of a clear understanding of the nature of their causation, such deplorable results as septicæmia, pyæmia, hospital gangrene, and erysipelas have been modified, abated, or radically prevented.

Every surgeon worthy of the name now takes "prevention" as his watchword, and the successful employment of preventive methods has made surgery a conservative branch of the art of healing.

Antiseptic surgery, then, is simply the prevention of sepsis or suppuration, — the result of a wound, whether surgical or accidental. Experience has taught the surgeon that such a wound, however large, will heal without suppuration, provided that the antiseptic precautions are rigidly enforced.

To an old-fashioned surgeon the nice preparations required for antiseptic surgery seem trifling and superfluous; and he is apt, in the remembrance of his own successes in capital operations, to attach but small importance to the details of precautions made by his younger neighbors. But after witnessing one or two of the manipulations by the new method, and after taking careful note of the details of every step, and how that every emergency is covered by the most delicate precaution, he is apt to fall into line (unless he be obstinate), and generously acknowledge the strong points in the new methods. The requirements of the operator are many, and they must be rigidly enforced. The room should be clean, with no superfluous furniture, and practically free from dust. The hands, arms, and nails of the operator must be thoroughly scrubbed, with brush and soap, in hot water. The region of the body to be operated upon must be carefully shaven of hair, and subjected to a thorough cleansing; then the hands are to be immersed for at least a minute in a solution of corrosive sublimate. Rings, especially those with stone settings, must be removed from the fingers, and the trinkets of nurses must be laid aside. The instruments must be minutely inspected, and subjected to a careful cleansing with soap and brush; great care being taken that no dry particles of pus or blood remain in the grooves or handles. These should then be immersed for several minutes in a three per cent solution of carbolic acid, or the one to a thousand solution of the bichloride of mercury. Every thing should be disinfected. Whenever an assistant touches an object not disinfected, — a chair or a door, — hands a basin, wipes his face, or scratches his nose, it is absolutely necessary that his hands be scrubbed and disinfected anew. Sponges should be beaten free from calcareous particles, then immersed for fifteen minutes in dilute muriatic acid, to dissolve the remnants of lime, washed in cold water, then kneaded by the hand in pure soap in hot water for five minutes, rinsed, and then immersed in a five per cent solution of carbolic acid, in which state they are to remain until required for use. Carbolic acid is better for sponges until used, as it does not become decomposed and inert, like corrosive sublimate.

When saturated with blood in an operation, sponges must be washed in hot water, then thrown into a basin containing carbolic solution, and handed to the surgeon.

Catgut prepared after the manner described by Kocher makes the best and safest ligature. Kocher's method is, to immerse the catgut for twenty-four hours in the oil of juniper (from the berry), then preserve in alcohol until wanted for use. Alcohol keeps the catgut soft and pliable, while carbolic acid or corrosive sublimate is apt to render them brittle and weak.

Silk is made unirritant, according to Czerny, by boiling it for an hour in a five per cent solution of carbolic acid, then preserving it in alcohol.

In perfect antiseptic treatment no drainage is required, for the secretions will become absorbed if they do not contain any thing capable of inducing putrid discharges. Even large blood-clots around a fractured bone will be harmlessly absorbed, and a blood-clot in an aseptic operation will be absorbed without local or general disturbance (Gerster). But in operations where large surfaces are exposed, and where the wound is very irregular, the possibility of even slight contamination should be kept in view, and vent should be provided for by proper drainage-tubes. If the healing is prompt, they can be withdrawn on the fourth or sixth day.

In the use of lotions, Gerster depends almost exclusively upon carbolic acid and corrosive sublimate as germicides. They are highly effective, easily obtainable, and simply prepared; and constant use has made them, in his hands, thoroughly tested and reliable.

The modes of dressing are many and varied, according to the nature of the accidental or surgical wound; but they all depend upon the general principle of asepsis.

Among these methods may be mentioned, as of most importance, *chemical sterilization* combined with *exsiccation*, which is included in the *dry* dressing so carefully described by Mackintosh; then there is the simple *chemical* sterilization involving the *moist* dressing. This dressing is indicated where rapid absorption is desirable, as in the presence of septic or fetid discharges, when clogging of the drainage is to be avoided.

The medication of the cheese-cloth or tobacco-cloth gauze is accurately described in the books under the different forms of corrosive-sublimate gauze and iodoformized gauze. In emergencies common batting or absorbent cotton can be utilized after being well soaked in the corrosive-sublimate solution, and well wrung out before using.

All this care and manipulation require hard work. The increase in this respect over the old methods is tenfold, and the attention demanded in dressings and vigilant oversight is vastly more exacting. But results show that the new method is the best. It certainly is based upon a fundamental principle that cannot be gainsaid by any of the successes that have been attained by the old methods. Older surgeons must not rest content

with the triumphs that have attended their operations, and rendered them famous. Those results were grand and praiseworthy. But Science is self-asserting, and will not "down at our bidding;" and it is the part of our profession to welcome with gladness whatever she unfolds. "The past is secure," and the future is full of glorious expectation in the development of truth.

[Specially compiled for the *Popular Science News*.]

MONTHLY SUMMARY OF MEDICAL PROGRESS.

BY W. S. WELLS, M.D.

M. BOSQUET lately reported to the Société de Chirurgie, Paris, a case in which the palmar arch was severely wounded by the fragment of a bottle, the flexors of the thumb and index being completely divided. M. Bosquet, after trying in vain to ligate the divided vessels in the palm, finally ligated the radial and palmar arteries. In the discussion, M. Champonniere expressed the opinion that good compression would have controlled the hemorrhage, and obviated the ligation of the arteries in the wrist, to which M. Bosquet replied that he feared to use the prolonged compression, on account of the inevitable pain which would result.

The *Medical and Surgical Reporter* calls attention to this subject to indicate what it believes is a widespread error in regard to the treatment of wounds of the blood-vessels in the palm, and thinks that the rule of practice ought to be to ligate in the wound, if this can be done without prolonged or laborious efforts; and if not, elevate the part, and apply a compress which has been soaked in cold water or some mild astringent, and then squeezed fairly dry, binding it on with moderate but not excessive firmness, and *maintaining the hand in an elevated position*. The *Medical and Surgical Reporter* lays stress upon how much can be accomplished by a rational use of elevation and moderate compression in the case of wounds of even large arteries, and believes that distant ligation should never be resorted to until the method it mentions has been fairly tried.

Certainly, in wounds of the palmar arch, much trouble to the surgeon and some risk to the patient might be avoided if this plan were at once put in use.

SUTURE of a wound of the liver is reported by Professor Postemski in the *Riforma Medica*. The operation, which is said to be the first of the kiud ever performed, took place in the Ospedale della Consolazione at Rome, two months ago. The abdominal wound was enlarged, and the edges of the wound, which was situated in the left lobe, and which was two and three-quarters inches in length and three-quarters of an inch in depth, were brought together by two catgut sutures, applied by means of extremely fine needles. The hemorrhage, which had been very free, was at once arrested, upon apposition of the surfaces of the laceration, and the dressing of the wound. Four days after the operation the patient's temperature was normal, and he was doing well.

THE operation of transplanting a nerve from a rabbit to a man was lately performed by Dr. Gersung, an assistant of Professor Billroth, and the patient is Professor Fleischl. Sixteen years ago Professor Fleischl received a wound at a post-mortem examination, which resulted in inflammation of the right hand and arm, and finally gangrene of the terminal phalanx of the thumb, which was amputated. Neuromata (tumors of the nerve) developed, attended with great pain; and the branches of the radial and median nerves were successively resected until the thumb and nearly all the fore-finger became anæsthetic. New neuromata continued to develop, however; and the pain became so intense, that the following operation was decided upon. The patient was put under the influence of chloroform March 4, and the neuroma was excised; the nerve-stumps of the two digital branches being also prepared. A rabbit was now killed, and as long a piece as possible of the sciatic nerve of the animal, with its branches, was dissected from it (the animal still exhibiting contractions). The piece of sciatic nerve was then inserted into the space between the central stump of the median nerve and its digital branches. The central end of the sciatic nerve was sutured to the connective tissue which covered the median nerve, and the two branches were sutured to the digital branches of the median nerve; the portion of nerve measuring about six centimeters, which was deficient, being thus made up. After the operation severe pain persisted for some hours, but finally entirely ceased, and healing took place by the first intention. The correspondent of the *British Medical Journal* states that pain has not returned since the date of operation, and it is hoped that the favorable condition will become permanent. Dr. Gersung expects with confidence that this will be the case, in which event the operation will be given an extended trial in other favorable cases.

PROFESSOR BALL (*Medical Record*) has met a case in which, during the course of acute rheumatism, general pulmonary congestion occurred, death following in a few moments. Cases in which the rheumatic affection leaves the joints, and appears in the lungs, are not frequent; but in from seven to ten per cent of cases of acute rheumatic fever some form of pulmonary or pleuritic complicatiou occurs.

A case of pulmonary rheumatism has recently been reported by M. Humblet in the *Arch. Med. Belges*. A butcher aged twenty-six, robust, was attacked for the first time with acute rheumatism. Under treatment by salicylates all pain disappeared. At the end of fourteen days he suddenly developed signs of consolidation of the lungs, with fever and "rusty" sputum. These symptoms were overcome by local treatment, whereupon the rheumatic symptoms abandoned the lungs, and settled in the left wrist. After twelve days the same symptoms appeared iu the lungs as before; the joint affection disappearing, to reappear again in a few days. Finally both the pulmonary and articular symptoms gradually began to disappear, and convalescence followed.

The rheumatic poison seems to affect the blood, with a condition peculiarly liable to develop inflammation of the hearts or lungs, or their encircling membranes respectively, — the pericardium and pleura.

DR. C. H. H. HALL, U. S. Naval Hospital, Yokohama, Japan, reports the successful dispersion of opacities of the cornea by means of galvanism. Of the seven cases under treatment, the opacities varied in size from that of a millet-seed to the whole circumference of the cornea, from a nebula to a dense white leucoma, and in duration from forty days to forty-eight years. All of these cases are steadily improving. The rate of disappearance seems to depend chiefly upon the size of the opacity, which, like a heap of snow, melts away from the periphery toward the centre; the oldest but little more slowly than the most recent.

The method he employs is as follows: One pole of the battery in the palm of the hand, the other upon the closed eyelid; ordinary sponge-covered electrodes being used. If the eye is or becomes congested, or the seat of pain, the anode (positive pole) should be placed there; otherwise, the cathode should be used as the therapeutic pole, its action apparently being more rapid. The strength of the current should not exceed three milliampères; and usually two are better, as less irritating to sensitive eyes.

The sitting should not exceed three minutes, and should not be practised oftener than every other day. A galvanometer and a smoothly working galvanic battery are indispensable in this treatment. The doctor uses Barrett's milliampère meter and chloride-of-silver battery.

IPECAC inhalations for various diseases of the lungs and air-passages is advocated by Murrell in the *Medical Press*. He reports six cases greatly benefited by inhalations of wine of ipecac in spray. He obtained most benefit from this in cases of chronic bronchitis and bronchial catarrh. In phthisis there was marked amelioration. A single inhalation will sometimes restore the voice in cases of hoarseness due to congestion of the vocal cords. The spray should be given warm, and the patient should remain in-doors for some time after the inhalation.

Care should be taken to be sure the spray enters the chest, and is not stopped by the arching of the tongue against the wall of the mouth. Ten minutes, spraying three times daily will suffice.

THE *Cologne Gazette* remarks upon the confusion recently occurring among a large body of Russian troops, being drilled at night; a large number of them being affected by night-blindness. Dr. Meissner demonstrated that the defective vision originated from imperfect nutrition. It occurred during the observance of the Greek fast, when the inhabitants eat no animal food. Soon after resumption of the usual diet, the vision became normal. This disturbance occurs sometimes in insufficieutly-fed nursing-women.

DR. PESET Y CEVERA writes to a Spanish medical journal concerning a new process to distinguish between human and animal blood. He says: "If blood be mixed with a little bile, small crystals are formed which are of different shapes in different species of animals. In man they are stated to be right-angled prisms; in the horse, cubes; in pigs, right-angled prisms very similar to those seen in rhomboids; in sheep, rhomboidal plates; in dogs, human blood; and in chickens, more or less regular cubes."

A PHILOSOPHER'S PRESCRIPTIONS.

SOME OF THE OBSERVATIONS OF LORD BACON.

MEDICAL science could scarcely be said to exist when the wisest man of the age (next to Shakspeare) could gravely propose a number of opinions which the least-instructed practitioner of our day would laugh at as ridiculous. Thus, Bacon writes that, though the strongest opiates are to be used sparingly, the milder sort may be used in daily diet, and contribute to prolong life. "An apothecary of Calicut is, by the use of ambergriz, reported to have lived a huudred and sixty years; and the nobility of Barbary are, by the use thereof, found to be long-lived, while the common people there are but short-lived. And our ancestors, who made a frequent use of saffron, lived much louger than we do." He recommends that an opiate diet should be taken every year, about the end of May, "because the spirits are most dissolved and attenuated in the summer;" and the opiate employed must be "a commanding one." He considers that, however much air may contribute to health, "yet

the shutting of it out externally conduces to longevity;" and so, in his judgment, does a life in caves, into which the sun's rays cannot enter. And Lord Bacon is emphatic on the necessity of preventing a "dissolution of the spirits,"—whatever that may be,—and advises people to guard against this by anointing themselves with oil, which also causes long life; yet it has its dangers, for "the spirits, when shut up, and not suffered to perspire, grow warm." Some of his recipes are a little wasteful; as, for example, when to recreate the heart he advises pouring fragrant wine into a hole made in good, fresh earth, and stirring the moistened mould about with a spade: and, in accordance with the old Pharmacopœia, he also advises the internal use of gold and pearls—the latter to be taken in levigated powder, or in a solution made with the juice of fresh and tart lemons. Pigeons nowadays are not kindly treated at Hurlingham; but, if Bacon's advice were followed, they must have had a hard time of it in his day, for he asserts that in a dangerous illness great use is made of live pigeons cut asunder and applied one after another to the soles of the feet.

In the course of his observations on health and disease there are remarks which show how rare some things were then with which we are now familiar. Thus, we are told how the Turks use a kind of berry called coffee, which they roast, powder, and make into an infusion with hot water. "The drinking of this, they affirm, adds strength and vigor to the mind and body, though when taken immoderately it disorders the senses." It is evident that he had never tasted a beverage now familiar to every one. Burton, who lived about the same time, also writes, by report, of a drink called coffa, "so named of a berry as black as soot and as bitter," which the Turks "sup as warm as they can suffer," finding that it "helpeth digestion and procureth alacrity." Tobacco, Lord Bacon states, had spread wide in his time, and "gives a secret delight to those who take it. It condenses the spirits, but, like opiates, manifestly disturbs the head." The great value of flannel was, it is clear, unknown in the Elizabethan age; for Bacon observes: "It is a practice among the wild Irish, when first taken sick, immediately to unsheet their bed, and roll themselves in their blankets; and some declare themselves to have, with great advantage to their health, worn flannel waistcoats and drawers next their skins." Again: he notes that the habit familiar to the ancients, and equally familiar in our century, of drinking hot liquids, had grown into disuse in his time. So he advises that the first glass of liquor should be always taken hot at supper, and adds that wine in which gold "has been quenched" is the most wholesome at meals: "not that gold communicates any virtue to the wine, but as knowing that all metals quenched in any liquor give it a powerful astringency; and we make choice of gold because it leaves no other metallic impression besides the desired astringency behind." Artificial teeth were unknown to Bacon, for he observes that the production of new ones is extremely difficult, and not possible without a powerful renovation of the whole body; indeed, he can only suggest that food should be so prepared as not to require chewing. Dr. Johnson thought that every one should be "blooded" once a month; and Bacon rather inclined to think that phlebotomy conduces to long life, "because it discharges the old juices of the body, and gives occasion to new." According to the Lord Chancellor, the great thing to be done if you aim at health is to keep in the spirits, and prevent their dissolution. If you ask what the spirits are, he replies that they are the agents and fabricators that produce all the effects in the body,—a reply that is not likely wholly to satisfy the reader. And, indeed, his views of life and health can scarcely be the result of experience, when he writes, in his *De Augmentis Scientiarum*, that some remedies which strengthen the faculties and prevent diseases are yet destructive to life, and that others which prolong life are not to be used without danger to health. With a curious and characteristic anecdote told by Lord Bacon in *Sylva Sylvarum* I must conclude this brief and imperfect record of a philosopher's prescriptions. After saying that he had a wart on his finger from childhood, and that, when a youth in Paris, at least a hundred grew upon his hands in a month's time, he adds:—

"The English ambassador's lady, who was far from superstitious, told me she would get away my warts; and, in order to do it, she rubbed them all over with the fat side of a piece of bacon with the rind on,—and, among the rest, the wart I had from my childhood,—then nailed the bacon, with the fat toward the sun, upon a post of her chamber window, which was to the south: and in five weeks' time the warts went away, and the wart I had so long endured for company. At the rest I did not wonder, because, as they came in a short time, they might go away so too; but the vanishing of that which had remained so long, sticks with me."—*Pacific Record of Medicine and Surgery.*

THE ANÆSTHETIC REVELATION.

Dr. Felix Oswald's account of the drugs which artificially stimulate various emotions does not include sulphuric ether, probably from want of space. Within a few years it has been discovered that this anæsthetic often produces a most singular effect on the mind of the patient or experimenter who has taken it, giving rise to what has been called the "anæsthetic revelation." Just as the experimenter recovers from the anæsthetic, and before wide-awake consciousness fully returns, he has an intense perception of what seems to him at the time the philosophic secret of existence,—the true explanation of the universe. This singular impression, though intense, does not last long; and, in spite of the subject's strongest effort to carry the "revelation" out into wide-awake consciousness, he finds himself unable to do so, but is left full of awe by his strange experience, and wonder at the nearness of the solution, which for so many ages has been sought so far afield. The present brief account has been gathered from the literature of the subject, which grows yearly. Mr. Benjamin Paul Blood of Amsterdam, N.Y., the discoverer of the phenomenon, originally made it known to psychologists in a pamphlet entitled *The Anæsthetic Revelation;* and he has since discussed its philosophical bearings in the *Journal of Speculative Philosophy*, January, 1886. The most scientific account appears in *The Therapeutic Gazette* for August, 1886, where Dr. George E. Shoemaker of Philadelphia relates his *Recollections after Ether-Inhalation.* Dr. Oliver Wendell Holmes mentions the experiment in his *Mechanism of Mind and Morals*, and a letter from the poet Tennyson concerning his own experience has recently reached the press.

The abstract, philosophic nature of the ether-dream gives it a special interest to students of philosophy and psychology. By its intensely specific character it differs entirely from the opium or hashish hallucination. The opium-eater may dream of a thousand different things; but the ether patient invariably has one fixed impression,—a belief that the ultimate secret and explanation of existence stands revealed to him as finite knowledge never has and never could reveal it. The singular thing is, that this impression may happen to a man who has never given one thought to philosophy, and whose mind, therefore, is void of material for this impression. This fact, and the specific likeness of effect of the ether on all who have made the experiment, has led some psychologists to declare the impossibility of considering the phenomenon a dream, and to claim place for it as genuine philosophic insight.—Xenos Clark, *in The Open Court.*

[Translated from *Le Monîteur Industriel.*]

SALICYLIC ACID IN FRANCE.

The Paris Court of Appeals has just declared that the addition of salicylic acid to beer constitutes an adulteration. The following is the decision of M. Muller, the presiding judge:—

"Although the addition of a foreign substance to an article of food may not always be considered as an adulteration, the case is different when by the admixture the seller deliberately alters the quality of the substance, to the prejudice of the purchaser.

"I consider that the addition of salicylic acid to beer constitutes a true alteration of the product, and that the admixture modifies the nature of the substance offered to the public, and introduces a new element which does not enter into the ordinary manufacture of beer, but gives to it a different character.

"I cannot allow that the addition is harmless, and does not act to the prejudice of the purchaser, as provided in the penal law.

"I consider that it is certainly to the prejudice of the purchaser, as beers of good quality need no addition of salicylic acid to prevent fermentation, and that this addition is really for the purpose of giving to the beer an apparent superiority which it does not possess.

"The danger to the public health from salicylated beers has been actually proved by science. Salicylic acid is really a medicine, sometimes useful, often dangerous, the administration of which should be made under the direction of an experienced person, and which the government cannot relegate to merchants acting only for the interest of their business, as the purchaser may thus receive injury to his health by the employment of this pretended preservative agent, which, when taken in doses more or less frequently repeated, may act greatly to his prejudice.

"Considering, then, that the falsifications resulting from this fraudulent mixture tend to change the nature of the substance sold, to the prejudice of the purchaser, it is decided that the lower court has made a correct interpretation of the law."

THE FEEDING OF CHILDREN.

Not until three years old should a child be permitted to take its meals at the table. Parents should understand that even then he has not reached an age when a full diet can safely be allowed.

First of all, he must be taught to eat slowly; and parents certainly ought to set the example. The habit of "bolting" food, so common to many, both children and adults, is an extremely pernicious one, for which there is no excuse.

Even before this period, sound fruits may be allowed children, provided, of course, those easy of digestion are selected, and care is taken to remove the seeds, skins, etc. It will be well to encourage them, when they join the family at the table, to eat a small quantity of fruit for breakfast, and before other foods are served. For this meal, children may be allowed milk, oatmeal, bread and butter, and eggs either lightly boiled, poached, or

scrambled. If, instead of eggs, they prefer fresh fish or steak, either one or the other may be given; the meat, of course, must be minced fine Fried foods are forbidden, and this includes fritters and fried cakes.

At dinner, if the soup is thin, it may be allowed; but that kind of soup so often found in the home of the laborer, and which is made from bones, thickened with vegetables, and strongly flavored with onions, is entirely unsuited to a child's digestion, and should never be given it. Roast or boiled meats, such as beef or mutton, may be allowed. The fact that pork and all salted and otherwise cured meats are difficult of digestion should be remembered, and their indulgence forbidden.

Potatoes, baked or boiled, dry and mashed, spinach and peas, string beans, asparagus of good quality, cauliflower, and beets when young, are no burden to a child's digestion, and should be allowed; with green corn it is different, unless that which is very tender is used, and the kernels are carefully crushed or grated. Such vegetables as turnips, cabbage, carrots, parsnips, and onions require strong powers to digest them. The same may be said of celery unless it is stewed. While the vegetables which have been recommended as a part of children's dietary are usually well borne by them, it must not be assumed that they can safely eat them all at one meal; only two of them should be partaken of each day.

For supper, milk toast, bread and butter, and a glass of milk, with possibly a little stewed fruit, will be quite sufficient for young children. Hot bread, cheese, and hashed meat and vegetables, so often the supper of the hearty workman, is altogether too indigestible for young children. In fact, it should be the duty of the mother to learn what foods are easily digestible, and none others should be allowed. Her own powers of digestion, or those of the father, cannot by any means be considered a safe guide in the selection of food for her little one. — *Boston Journal of Health.*

ANTI-VACCINATION THEORISTS.

THE people who oppose vaccination are, perhaps, not numerous; but they are decidedly noisy, and seem bent on making themselves as conspicuous as possible. When a man deliberately asserts in a public assembly that "proof after proof has been brought forward that this vaccination, as it is called, is utterly without avail in protecting the community or individual from the dread variola," one hardly knows how to deal with the declaration, it is so extravagantly inaccurate. No one, indeed, will assert that vaccination invariably protects; but its failures are, in a majority of instances, attributable to defective power in the vaccine matter, or careless manipulation, and do not affect the underlying principles in any way. When the beneficent results of Dr. Jenner's discovery are contemplated, indeed, a feeling of wonder arises at the perversity which can ignore all the cumulative evidence of the prophylactic virtues of vaccination. Before it was introduced, the ravages of smallpox were so terrible, that in the seventeenth century it was difficult to find in London a person unmarked by the disease. Of those who were attacked by it, a fearfully large percentage died, while the convalescents bore the scars to their graves. It then killed white men as quickly as in later days it has killed Indians. Vaccination has unquestionably drawn the poison-fangs of the disease. To-day smallpox, even in its most virulent forms, is never the scourge it was formerly, and ordinary attacks are as easily treated as measles. Vaccination has been proved in the most conclusive way, and by the longest and most extended trial, to be an invaluable prophylactic. It may be said that it has practically put an end to the epidemic form of variola, and to call it an "infliction" is about as irrational as to denounce life and fire insurance or the use of anæsthetics. — *New York Tribune.*

MEDICAL MEMORANDA.

A CASE OF SLOW PULSE. — Dr. Czarkowski reports the case of a boy five years of age who had a pulse of thirty-two to the minute. The slow action of the heart was thought to be due to cerebral anæmia; and under treatment directed toward this condition, the pulse ascended gradually to sixty, beyond which it could not be made to rise.

A USEFUL OINTMENT. — Gum, camphor, and salicylic acid, equal parts by weight, rubbed together in a mortar, dissolve, and make a clear, colorless, thick fluid, about the consistence of honey. This, when applied with a camel's-hair pencil to many of the itching eruptions that are prevalent, at once relieves the itching and burning sensations, and effects a cure in a short time. It is readily incorporated with petrolatum, and may be exhibited in the form of an ointment. — *Indiana Pharmacist.*

A BRAVE PHYSICIAN. — The *British Medical Journal* mentions, as an instance of the devotion of medical men to humanity, the case of Dr. Landon, a surgeon in the British army. Mortally wounded himself, and with the agonies of death closing in, he heard a wounded soldier shrieking from sufferings. Forgetful of self, he crept to where the man lay, and gave him a hypodermic injection of morphine to relieve his distress, and, giving it, died.

SIX LIVING GENERATIONS. — Dr. R. B. Root of Georgetown, Mass., writes as follows to the *Boston Medical and Surgical Journal:* —

"Last May I attended Mrs. Newall Rogers of Byfield, with her first child. I was then informed, and I have since taken the pains to verify the statements then made, that this baby is the *sixth living generation*, with ages as follows: Great-great-great-grandmother, 95 years; great-great-grandmother, 74 years; great-grandfather, 59 years 8 months; grandfather, 39 years 4 months; mother, 16 years 2 months; child, 11 months.

THE CHEMICAL INCOMPATIBILITY OF ANTISEPTIC AGENTS. — R. Boxall has studied the chemical relations of a number of the most common antiseptic agents, and finds several of them incompatible with oils and soap, as well as with one another. For example, corrosive sublimate forms an insoluble soap when a neutral soap solution is used. Hence a small admixture of soap will precipitate all the mercuric chloride in a solution. Therefore, after washing the hands, they should be thoroughly rinsed with fresh water before immersing them in a bichloride-of-mercury solution.

ALCOHOL AND CRIME. — Some figures with reference to alcoholism and criminality were recently communicated to the French Academy of Medicine by M. Marambat. They referred to an examination of three thousand condemned persons; and it appears that 79 per cent of the vagabonds and mendicants were drunkards, 50 to 57 per cent of assassins and incendiaries, 53 per cent of persons convicted of outrages on morals, 71 per cent of thieves, sharpers, etc. In acts of violence against the person, 88 per cent were found to be drunkards; against property, 77 per cent. Among youths under twenty, drunkards were nearly as numerous as among adults, the difference being only 10 per cent. Of these youths, 64 per cent were addicted to drinking. An examination of the departments showed the largest number of drunkards from the regions where spirits are most largely consumed.

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Publishers' Column.

THINK carefully, and express your thoughts concisely with one of Esterbrook's easy-writing pens.

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CAIRO, ILL., July 14, 1887.

FRIEND BOYLE, — Yours of the 12th inst. to hand, and was glad to see, from your circulars therein, proved conclusively, that the improved "Boyle" was on "top of the heap." Glad to hear it, and wish you all the success imaginable, as you are certainly deserving of it. Our five-year-old "Boyle" (15-ton machine) sings praises to you never ceasing; it has never faltered for a moment, nor cost us a cent for repairs.

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F. L. GALIGHER,
Manager Distilled Water Ice Co.

THE TREATMENT OF ULCERS. — An article appeared in the *London Medical Record* for Dec. 15, 1887, giving interesting details of the treatment of ulcers by phosphoric acid, as shown by the experience of Dr. Grossich.. By this method of treatment she used a ten per cent solution of pure phosphoric acid in distilled water. The ulcer is covered with a bit of lint dipped in this solution, and the dressing renewed three or four times a day. The patient for the first few minutes feels a slight burning sensation; but this soon passes, and within twenty-four or thirty-six hours the ulcer cleans, and looks better. Inflammation or eczema of the surrounding parts disappears, and all pruritus ceases. The ulcer cicatrizes rapidly, and the cicatrix is firm and healthy.

Kollischer treated tubercular affections of the joints with injections of the phosphate of lime, with great success. Dr. Grossich has also had good results with this treatment, and cites some very interesting successful cases.

The treatment by the solution of phosphoric acid was further employed in a case of tuberculous abscess of eight months' duration, and also a case of eczema marginatum which had lasted more than a year, and good results followed.

The above suggests the superiority of HORSFORD'S ACID PHOSPHATE as a substitute for the phosphoric acid.

The effective acidity of this preparation is about the same as the ten per cent solution of phosphoric acid which is prescribed in the above treatment, and it may therefore be justifiably employed by the profession in the treatment of disorders of this character. It has the advantage of containing the phosphates in solution, notably the phosphate of lime. It follows, then, that all cases that require the phosphoric-acid treatment can be more advantageously treated by HORSFORD'S ACID PHOSPHATE, and the suggestion is hereby commended to the profession.

The Popular Science News

AND

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CONTENTS.

FAMILIAR SCIENCE.—The Wonders of Spectrum Analysis. 129
A Few Hours in the Glasgow Exhibition 129
Kent's Cavern: its Wonderful Story of Prehistoric Man.. 130
Soap-Bubbles 131
Chemistry 132
Scientific Brevities 132

PRACTICAL CHEMISTRY AND THE ARTS.—Tanning 133
An Electrical-Current Meter 133
A New Lecture Apparatus for Demonstration of Reflection and Refraction 133
An Easy Method of Finding the Specific Gravity of Liquids, 133
The Stolen Secret of making Citric Acid 134
Verifying Graduated Glass Tubes 134
An Experiment to illustrate Quantivalence 134
Laboratory Notes 134

HOME, FARM, AND GARDEN.—The Chemistry of a Match.. 135
The Edelweiss 135
Hops 135
A "Roast of Rubbish" 136
What the Cow gives us 136
Horticultural Hints 136

EDITORIAL.—A Curious Experiment 137
An Immense Bowlder 138
Fermentation 138
To ascertain the Distance to the Moon 139
Meteorology for July, 1888 139
Astronomical Phenomena for September, 1888 139
How Birds Learn to Sing 140
Optical Illusions 140
Questions and Answers 140
Literary Notes 140

MEDICINE AND PHARMACY.—Illustrations of Antiseptic Surgery 141
Successful Modern Dentistry 141
Kuhnia as a Medicine 142
Monthly Summary of Medical Progress 143
The Sightseer's Headache 143
Some Answers in Physiology 144
Medical Memoranda 144

PUBLISHERS' COLUMN 144

Familiar Science.

THE WONDERS OF SPECTRUM ANALYSIS.

THE solar spectrum, as shown in the rainbow or dewdrop, has always been a familiar object to mankind; but it is only within the last quarter of a century that the marvellous facts written in the rays of light from the sun and stars have been revealed to us. Two German scientists, Bunsen and Kirchoff, first carefully investigated the phenomena of the spectra of the light proceeding from various luminous bodies; and their labors, with those of others following in their footsteps, have opened up a field of investigation which is apparently limitless.

It would require too much space to give a complete description of the theory and methods of spectrum analysis: we can only glance at the results obtained. We may briefly say, however, that, when a ray of light is passed through one or more glass prisms, it is separated into its constituent parts, or spread out into a broad ribbon containing numerous bright or dark lines, which indicate the presence of different elements, as well as many other facts concerning the condition in which they exist.

One of the most useful applications of the spectroscope is to the analysis of different substances. The chemist would be unable to detect with his reagents the presence of small quantities of certain elements; but let him bring the substance into the flame of a lamp, and glance through his spectroscope, and in a moment their presence or absence is indisputably proved. A ten-thousandth part of a grain of sodium can be easily detected by this means; and simply clapping the hands near the flame will give off enough of this omnipresent element to cause its characteristic yellow line to appear at once in the spectroscope. We have by this means proved the presence of the rare element lithium, in the blood of a person who had been drinking a mineral water containing a trace of its salts.

Not only does spectrum analysis show us the presence of familiar elements, but sometimes lines are observed indicating the presence of those previously unknown. Cæsium, rubidium, indium, gallium, thallium, and several others were thus discovered, although present in such small quantities that no ordinary reagent could have detected them.

But still more wonderful are the facts made known to us when we turn the spectroscope towards the celestial bodies. Every ray of light reaching us from the sun bears a message which, with the aid of the spectroscope, we can read as easily as we can read the words on those minute photographs which are only visible through a microscope. The characters of many ancient inscriptions are still undeciphered; but the story told by the little dark lines crossing the solar spectrum is perfectly familiar to us, although only a few chapters of it have as yet been interpreted. We know that iron, sodium, platinum, and many other elements, are present in the sun in the state of vapor; and it has been well said, that if the word "iron" appeared on the disk of the sun, the proof of its presence would be much less perfect than is that furnished by the lines which it causes to appear in the solar spectrum.

The spectrum of fixed stars, comets, nebulæ, variable stars, etc., all give us an immense amount of information concerning them. We may judge of the temperature of the stars, and calculate the speed at which they are moving toward or from the earth. It tells us that comets are, in part at least, gaseous bodies, and distinguishes between those nebulæ which are simply distant clusters of separate stars, and those which are masses of glowing gas not yet cooled down to the liquid or solid state. It told us that the wonderful star which for a few weeks in 1866 blazed out so brightly in the constellation of the Northern Crown, was enveloped in a mass of glowing hydrogen gas, and shows us, that, in the sun's atmosphere, there exist substances unknown to us on the earth, which may prove to be the component parts of some of our so-called elements, disassociated under the intense heat there prevailing.

The spectroscope shows the presence of more or less moisture in the upper air, with the accompanying probability of rain or fair weather; it shows the presence of the constituents of blood in solution, besides many other organic substances; and finally, the spectrum of the light from certain rare metals glowing in a vacuum under the influence of an electric current, proves their compound nature, although, to the coarser chemical and physical tests, they are simple elements incapable of subdivision.

Although we have only mentioned a small part of the results attained by this marvellous analysis of light, we have shown its immense scientific importance, and indicated what it may reveal in the future. Hardly a day passes but some new development is brought forward; and it seems probable, that, if we ever reach a knowledge of the actual nature and constitution of matter, it will be by the aid of the subtile and immaterial rays of light, which, as they flash through infinite space, seem to bear with them some of the profoundest secrets of the universe.

[Original in *Popular Science News.*]

A FEW HOURS IN THE GLASGOW EXHIBITION.

BY K. B. CLAYPOLE.

A FEW hours is by far too short a time to give to an exhibition so large as the one now open at Glasgow, and so full, moreover, of objects worthy of study. Nevertheless, under good guidance, and with the determination to pass those things which are not especially distinctive of this exhibit, a great deal may be done. Accordingly, on first entering we resisted the temptations of the department of fine arts, and turned our attention to the chemical crystals, which attracted us greatly; and we had to be reminded that though the exhibit is exceptionally large, there is nothing in it particularly new. We could therefore afford but a passing glance at the yellow and red prussiate of potash, the scarlet bichromate of soda, yellow chromate of soda, soft white soda crystals, bichromate of ammonium, and the mass of ten tons of alum crystallized in the form of a hollow cylinder. In the same way we hurried past soap and stearine in every stage of manufacture, from crude and refined oils and other raw materials to shapes and forms demanded by modern civilization; the prosaic nature of the display being relieved by fine stearine statuary, landscapes in mottled soap, and life-size busts of the Queen, members of the royal family, Robert Burns, Sir Walter Scott, Dr. Livingstone, President Garfield, and the Laocoon

group in white Windsor, with a tower six feet in diameter ornamented with bas-reliefs from Thorwaldsen and Giovanni.

The Clyde being a centre of the ship-building industry, a large exhibit of naval architecture and engineering was to be expected; and the main avenue of the building contains models which at once arrest attention, not only for the sake of the ships they represent, but for the beautiful finish that has been given to every detail of their construction. The principal lines to all parts of the world are well represented, and even a cursory glance excites interest in the different arrangements needed for the different waters over which these ships must sail, and the different purposes for which they are constructed; and most interesting to transatlantic visitors, who, within a few hours, have seen the gigantic ships themselves in the docks of Thomson, James, and George, are the "City of New York," and "City of Paris," now building for the Inman and International Line. A length of 560 feet, with breadth of 63½; fifteen watertight compartments, separated by steel bulkheads in such a way that two could be knocked into one without rendering the vessel unseaworthy; twin-screws and boilers separated into three groups by two of the compartments, and special arrangements in the triple expansion engines, — mark an important advance in the direction of safe and comfortable travelling at sea, and justify the hope that the passage will be reduced to five days.

But neither ships, nor parts and fittings of ships, must detain us longer: the large exhibit of women's industries is a special feature of this exhibition, and we must turn into the courts allotted to it. Here we are at first bewildered with the array of screens, lectern-cloths, curtains, missal-paintings, fans, Christmas-cards, painted china, from every part of the world, with dolls dressed in the national costume of the exhibiters. We are interested to hear that much of the embroideries, both the white on delicate muslin, and the richly colored on satin and velvet, has been done by peasant-women in their own kitchens, the materials having been provided by ladies interested in woman's work. The lace displayed is all hand-made, its colors, texture, design, and stitch all bespeaking, to a practised eye, the nationality of the maker, and often the very district in which she lives. Here and there we may see her now before us, dressed in her native costume, and plying her bobbins according to the fashion of her ancestors for many centuries past. Two dark-haired, rosy-cheeked lasses look at us with bright eyes, and encourage us to conversation. They are making Honiton lace, very difficult to learn; but the art once acquired, any pattern can be worked with ease; it is not hard on the eyesight; their grandmother over eighty can see to make it now. "Without glasses? Yes, indeed. No one wears glasses in Devonshire: there is no short sight there, every one has good sight."

There is a great deal of work going on in these courts. Gloves are being made, from the first cutting of the kid to the embroidery on the back. Welsh women are weaving their check-flannels on looms of ancient construction; and wool is carded, spun, and woven into the plaids, petticoats, blankets, and cloths typical of many of the Scotch islands; and a fair-haired girl from Shetland sits placidly spinning, while two others knit those lacey shawls which are at once so light and warm.

We seek next for what is being done for and by the rising generation, and find large exhibits of plain needlework, darning, patching, etc., showing that sewing is not yet one of the lost arts, and that it shall not become so in this generation. Germany has models illustrative of methods of teach-

ressmaking and millinery and needlework generally. The mission schools do bravely, and those in connection with the Society for Promoting Female Education in the East present many varied features. From the display made of pupils' work, it would seem that Indian girls accomplish only embroideries ill finished, though gay in color, and sometimes glittering with gold and silver threads; while the Kaffir girls devote themselves to the making of underclothing and baby-clothes with the greatest possible neatness and precision. It is said, indeed, that little Kaffir girls always turn over the dolls given them by missionaries, and examine the underclothes; while their Indian sisters look out only for dress and style.

There is an exhibit of appliances for teaching science and art to the blind, and, it would seem, every branch of a liberal education. Astronomical and geographical maps have been prepared, a Euclid, various plans and diagrams, volumes of Scotch, English, and ancient histories, music, dictionaries, frames for writing, and erasers for removing faulty or superfluous dots. That technical education is now receiving some measure of attention, is proved by models for teaching physics and science, — the greater part coming from Germany; by models of mechanism, examples in building construction and solid geometry, from the Dundee High School, and by engineering instruments, patterns and drawings, and models of machines and parts of machines made by pupils of the Glasgow and West of Scotland Technical College. Most interesting to naturalists are two cases lent by Professor McIntosh of St. Andrew's University and Marine Laboratory, containing eggs and young of the food-fishes. Here, in small sealed bottles, are seventeen specimens of the whiting, showing its development from egg to perfect fish; thirteen of the gray gurnard; and fourteen of the flounder, flat from its earliest infancy. Here, too, are minute salmon with their egg-sacks still attached; and larger specimens, the prey of internal or external parasites; and on a shelf above the parasites, bottled in alcohol, are specimens of the victims of the salmon itself.

The exhibits illustrating the natural history and industries of Ceylon are of great interest. The former are mainly set out in the square enclosure in the middle of the court, surrounded by a simple Kandyan railing. In the centre is a rockwork composed of blocks of the chief minerals of Ceylon, and covered with specimens of the *flora*. Various wild animals found in the island stand on the ledges; and the rockwork is surmounted with a zinc model of a Dagoba, or shrine, in which the devotees of Buddhism preserve their sacred relics.

The staple industry of Ceylon — the growth and manufacture of tea — is represented in all its stages: the rockwork shows specimens of the growing bush; while an entire side of the building is taken up with cases containing different kinds of the prepared leaf, and drawings illustrative of the various stages in the manufacture. Other natural and industrial products are also fully represented, such as the numerous preparations of the cocoa-nut, plumbago, coffee, cinchona, cinnamon, etc.; and model representations give one a good idea of such industries as pearl-fishing, arrack-distilling, and capturing wild elephants in a kraal. Similar models are a great feature of the Indian courts; and, did time permit, a good knowledge of the life of the natives might be obtained. On a stand is a model of an opium-house with smokers in every stage of intoxication; on another is a school where Bengal boys are receiving their primary instruction; another model shows a landlord's court, where the payments of rice must be made, with three beehive-shaped granaries for the rice, and small, guarded prison-huts for delinquents. Better than models, the Hindoos themselves are giving an illustration of their modes of work, — fashioning pottery with their hands or on simple wheels, and burning it in small kilns; making native sweetmeats, and many other things, too, which we long to investigate. But our time is gone: and we dare not look towards the Machinery Department, or enter the Picture Gallery; for outside in the beautiful grounds, now gay with masses of rhododendrons, is a building made after the model of the old Bishop's Palace of Glasgow, and filled with historical relics, especially of the Stuarts; and more than this, there is the Museum, in which are to be seen about eight hundred of the jubilee presents of Queen Victoria.

[Original in *Popular Science News*.]

KENT'S CAVERN: ITS WONDERFUL STORY OF PREHISTORIC MAN.

BY SAMUEL BRAZIER.

PART II.

THE first deposit in the cave, i.e., the uppermost deposit, consisted of blocks of limestone varying from a few pounds to a hundred tons in weight, and often cemented together with stalagmatic matter. The next deposit below and between these blocks of limestone was a black mould composed chiefly of vegetable matter. This extended throughout the cavern, and varied from three inches to quite a foot in thickness. Beneath the black mould was the stalagmite, averaging about eighteen inches in thickness, but varying from an inch to upwards of five feet. This stalagmite, the general reader may like to be reminded, is formed by the water of the cave depositing the limestone with which it is impregnated. Water always contains more or less carbonic acid, which dissolves the limestone over which it passes. Dropping constantly from the roof to the floor of the cave, it there forms a thin film, which slowly hardens into limestone, and in the course of ages has increased to the thickness named. The water also leaves a deposit at the roof of the cave, at the spot from which it falls, forming slowly like an icicle. This limestone formation that depends from the roof of the cave is called stalactite: that which forms on the floor is stalagmite. Below the stalagmite, in one part of Kent's Cavern, was a black band composed mainly of charcoal, and covering a space of about a hundred square feet.

Next below was what was called "cave-earth," which was composed of about half light red loam, and half angular pieces of limestone.

In certain parts of the cavern the explorers came to a lower stalagmite which was crystalline, and under this a deposit called "breccia," which was really a second cave-earth, and of course of much greater antiquity than the one lying above and separated by the second stalagmite.

The reader will get a clearer impression of the relative antiquity of these deposits, and be able to better understand the method pursued in exploring the cavern, and the significance of the facts disclosed, if we recapitulate in the following manner: —

The order of the deposits, after the blocks of limestone which had fallen during an unknown period of time from the roof, was as follows: —

1. The black mould, chiefly vegetable *débris*, covering the floor of the cave to a depth varying from three inches to a foot or more.

2. Stalagmite of a granular character, varying in thickness from an inch to upwards of five feet, and averaging about eighteen inches.

3. The cave-earth (including the black band already mentioned), four or five feet in thickness.

4. A lower stalagmite, which was crystalline in character, and in places twelve feet thick.

5. The breccia, a second cave-earth of much higher antiquity.

In examining these deposits, it was necessary, for reasons already indicated, to proceed in a manner so careful and systematic, that it should be impossible even for scientific men to doubt the facts that should be recorded.

Not to weary the reader with details, let him imagine a datum line drawn from near the entrance to the back of the cave. Parallel lines to this, one foot apart, are drawn all over the cave. At right angles to these, other lines are drawn, till the whole cavern is divided into sections, each one foot square. The explorers examine each deposit according to these sections; beginning, of course, with the uppermost, the black mould. A section is first carefully examined *in situ* by candle or lamp light. It is then taken out, and brought to the entrance, and examined in the daylight. Every object that is not limestone is picked out and put into a box, into which nothing else is put. These boxes are taken to Mr. Pengelly's house each day. The specimens are washed, and the box numbered and labelled; the same number being put on every specimen belonging to that particular box. Then they proceed to the stalagmite, cutting it out in sections, break it up to see what is in it, and put any fossil that is found, into another box. Each deposit is taken out in the same manner; so that, in examining any specimen to-day, not only is it known in which deposit it occurred, but also the exact spot in the cavern where it was found, the distance from the entrance, the parallel line, and the level. This work was continued uninterruptedly for years, and many thousands of boxes of specimens have accumulated.

And now let us see what was found in the different deposits. In the uppermost deposit, the black mould, they found pieces of slate cut into various shapes, whetstones, pieces of smelted copper, and various kinds of combs made of bone. Some of the combs were rudely made, others were beautifully ornamented. Mr. Pengelly said he thought he could distinguish which belonged to the "missus," and which to the servant-maid. They found also flakes of flint, spindle-whorls, amber beads, hazelnuts, and charred wood. The bones and teeth of man were found with those of the following animals: pig, dog, badger, brown bear, ox, red deer, sheep, goat, hare, rabbit, water-rat, seal, birds, and fish; also the shells of snails, limpets, whelks, oysters, cockles, mussels, cuttle-fish, etc.

It will be seen that this list does not contain the names of any extinct animals. None were found in the black mould, which is therefore to be regarded as a modern deposit, covering a period of at least two thousand years, perhaps longer. The human remains might have belonged to Romans or ancient Britons, or races earlier than any which history makes mention of.

It will be evident that what is in the stalagmite is older than any thing in this black mould. In the first or uppermost stalagmite were found bones and teeth of the following animals, some of which belonged to races now extinct: rhinoceros, elephant, bear, hyena, fox, horse, and man. Flakes and cores of flint were found also, with stones of various kinds, shells of cockles and cuttle-fish, and charcoal and the impressions of ferns.

In the black band which we have said occurred in one part of the cavern were found three hundred and sixty-six flint tools, flakes, and cores, a bone awl, a bone harpoon, a bone needle having a well-formed eye, burnt bones, and remains of bear, hyena, rhinoceros, and other animals.

In the next deposit below, the cave-earth, were found stones which had come from distant places, as granite from Dartmoor, whetstones, hammer-stones, flint tools and flakes, a bone pin, two bone harpoons, burnt bones, charcoal, and bones and teeth of various animals, such as the wildcat, the cave hyena, the cave lion, several varieties of fox, glutton, badger, cave bear, reindeer, grizzly bear, wild bull, bison, beaver, the mammoth, and others.

We have referred to the doubt that was cast on Mr. McEnery's alleged discovery of *Machairodus* in Kent's Cavern. These excavations had gone on more than seven years, and no other remains of that animal had been found, although hundreds of thousands of bones and teeth of other animals had been dug out. The doubters were confirmed. But it is dangerous to trust to negative evidence. A tooth was at last discovered which undoubtedly belonged to that animal.

In the lower crystalline stalagmite the only animal remains that were found were those of the bear.

In the breccia, the lower cave-earth, an immense number of bones and teeth were found, all of them being those of the bear. Here also several flint implements were found.

And now as to the time required for the formation of these various deposits, in the lowest of which human implements have been found. Any thing like even an approximate estimate of the immense periods required would be impossible. At least two thousand years must be allowed, probably a much longer period was required for the formation of the black mould. Then we get to the still older stalagmite formed by the deposit of one molecule of limestone after another from the dropping water. This process could go on no faster than the rain that fell on the hill could percolate through the ground, dissolve the limestone at the roof of the cave, and carry it in drops to the floor. How small a portion of limestone could be carried in each falling drop of water! But we have five feet to account for, and twelve feet in the lower stalagmite. A curious fact enables us to give a sort of rough guess at the length of time required. In one part of the cave there is a huge boss of stalagmite rising up from the floor, the process going on in this one spot faster than elsewhere. This boss, or pillar, of stalagmite bears an inscription: "Robert Hedges of Ireland, February 20th, 1688." This inscription was described by the secretary of the Torquay Natural History Society in 1825. His description is good till now. The inscription is covered by a thin film of stalagmite about the twentieth of an inch thick. It has required, therefore, two hundred years to deposit a film of stalagmite one-twentieth of an inch in thickness. At this rate, which is much more rapid than that at which the whole has formed, it would require two hundred and forty thousand years to deposit five feet of stalagmite.

This calculation cannot, of course, be supposed to be even approximately correct. It only serves to show what long periods of time are indicated by this one instance in which human observation has been able in a rough way to measure the slow processes of nature. Then, under this stalagmite is the cave-earth; and lower still is the second stalagmite, much thicker and many long ages older than that above; and below all these, and older than all, is the breccia, a second cave earth; and in this oldest of all the cave deposits, human implements have been found.

The researches in Kent's Cavern helped considerably to revolutionize men's opinions as to the antiquity of the human race. How great that antiquity is, it is impossible to affirm; but we know enough to warrant the belief that man has lived on the earth during ages so vast, that, compared with them, the historic period is but an insignificant portion of time.

6 Allston Place, Boston, Mass.

SOAP-BUBBLES.

Soap-bubbles fill the same happy position as do those charming books in which Lewis Carroll describes the adventures of Alice, in that they serve equally to delight the young and to attract the old. Clerk-Maxwell has mentioned the fact that on an Etruscan vase in the Louvre are seen the figures of children amusing themselves with bubbles, while to-day the same subject is being forced on the attention of the world by a strange development of modern enterprise. On the other hand, the bubble has occupied the minds of scientific men of all times. Professors Reinold and Rücker have employed the soap-film in investigations which tend to throw more light on the molecular constitution of bodies. The latest experiments with bubbles, which were shown by Mr. C. V. Boys to the Physical Society and at the Royal Society *conversazione*, depend upon no property which is not well known, and, unlike those referred to above, are not intended to increase our scientific knowledge; and yet no one would have ventured to predict that bubbles would submit to the treatment described in the paper, or would have expected such simple means to produce such beautiful results.

The first property of the soap-film turned to account, is that strange reluctance of two bubbles to touch one another. Just as a bubble may be danced on the sleeve of a serge coat, or even embraced, without wetting the sleeve, or being broken, so can two bubbles be pressed together until they are materially deformed without really touching one another at all. One bubble may be blown inside another, and if the heavy drops which accumulate at the bottom are removed, the inner one may be detached and rolled about within the outer one; or the outer one, held by two moistened rings of wire, may be pulled out so as to squeeze the inner one into an oval form, or may even be swung round and round, and yet the inner one remains free and independent, and when the outer is broken it floats gently away. If the inner one is colored with the fluorescent material uranine, it shines with a green light, while the outer one remains clear as at first, showing that there is no mixture and no contact.

When the inner bubble is blown with coal-gas, it rests against the upper side of the outer one, pulling it more and more out of shape as its size increases. It can even be made to tear the outer one off the ring to which it was attached, after which the two bubbles rise in the air, one inside the other. The outer bubble may be held by a light ring of thin wire, to which thread and paper are attached, and then, when an inner bubble of coal-gas is blown, it will carry up the outer bubble, ring, paper, and all; and yet, in spite of this weight pressing them together, the inner bubble refuses to touch the outer one. If a little gas is let into the outer of two bubbles, the inner one will remain suspended, like Mahomet's coffin.

Diffusion of gas though a soap-film is shown by lowering a bell-jar of coal-gas over a bubble in which a second one is floating. By degrees the gas penetrates the outer bubble, until the inner one, insufficiently buoyed up, gently sinks down.

The heavy and inflammable vapor of ether is made use of to show the rapidity with which the vapor of a liquid which will mix with the soap solution, will penetrate through the walls of a bubble. A large inverted bell-jar has some ether poured into it, after which bubbles blown with air in the usual way may be dropped into the jar, when they will float upon the vapor. They are then taken out and carried to a flame, when a blaze of light shows that the inflammable vapor has penetrated through

the film. A bubble blown at the end of a wide tube, and lowered into the vapor, hangs like a heavy drop when removed; and if held in the beam of an electric light, the vapor is seen oozing through the film, and falling away in a heavy stream; while a light applied to the mouth of the tube fires the issuing inflammable vapor, and a large flame, like that of a bunsen burner, is the result.

A variety of experiments are described in which bubbles are rolled along troughs made of soap-film — either straight, circular, or spiral — the prominent feature being, that bubbles will roll upon or within one another, as if they were made of India-rubber; they will even, where apparently in contact, take up the vibrations of a tuning-fork, and this will not force them to touch. There is one influence, however, which they cannot resist; and that is electrification. When two bubbles which are resting against one another, provided that one is not within the other, are exposed to the influence of an even feebly electrified body, they instantly coalesce and become one, and so act as a delicate electroscope. When one bubble is within the other, the outer one may be pulled out of shape by electrical action, and yet the inner one is perfectly screened from the electrical influence, thus showing in a striking manner, that there is no electrical force within a conductor not even as near the surface as one side of a soap-film is near the other; for though the force outside is so great that the bubble is deformed, yet the fact that the inner one remains separate shows that the force within is too small to be detected. One of the experiments described shows at the same time the difference between the behavior of two bubbles, one blown inside a third, and the other brought to rest against the third from the outside. Under these conditions, if electricity is produced in the neighborhood, the two outer bubbles become one, and the inner one, unharmed, rolls down and rests at the bottom of the now enlarged outer bubble.

One experiment is described in which a cylindrical bubble is blown with oxygen gas between the poles of an electro-magnet. If the length is properly adjusted, the bubble breaks into two directly the exciting current is turned on; though the force due to the magnetic nature of oxygen is so feeble, that not the slightest change of shape can be detected in a spherical bubble under the same conditions. — *Nature.*

CHEMISTRY.

BY C. A. MAYO, PH.G.[1]

THIS, gentlemen, closes our preliminary course in general chemistry. Of the many wonderful truths revealed by this fascinating science, I have been able to give you a glimpse only.

In the physical world all is change, — continuous change. The slow disintegration of the hardest rocks yields soft, rich loam. The gradual absorption by the roots of plants changes this into an integral portion of the tenderest flowers.

The carbon which we see to-day as a black and grimy fuel, forms to-morrow a portion of a colorless, odorless gas. The gas is absorbed into the pores of the fresh green foliage; and we see the carbon again in the brilliant crimson of the rose, the pure loveliness of the lily, and the warm russet of the bearded grain.

With gleaming scythe the reaper garners the golden sheaves; and, through the homely arts of the miller and housewife, the carbon comes upon the table in sturdy brown loaves or tempting sweets. It blooms in the damask cheek of the fair young girl, strengthens the sinews of the sun-browned toiler, and stays yet a little while the waning vigor of the old man slowly tottering to his grave; and when at last the dull rumble of the clod upon the coffin-lid strikes a sudden, solemn chill to the heart of the mourner, and we say of the departed, that, "after life's fitful fever, he sleeps well," we know, that, in only a little while, the clay now lying cold and silent in the tomb will live again in the verdure of the spring and the bloom of summer.

Each leaf and blossom is but the rehabilitation of atoms, which, in the eternal round of "strange mysterious change," in other forms have lived and loved and died.

The summer winds, whispering sweet and low through the solemn arches of the pines, but give inarticulate voice to tongues of birds and men which sung and laughed beneath them, but which in the round of "change from birth to death, from death to birth," now murmur softly in the cool green foliage. Matter is indestructible: nothing is lost; all is changed. And if the coarser earthy element of ourselves, the body, is never destroyed, but lives again in other shapes, performing other duties, can it be that our higher parts, the intelligence, the soul, shall be resolved into nothingness? No: it cannot be! We look through Nature up to Nature's God, confident, that, in the spiritual as in the physical world, matter is indestructible, nothing is lost.

"The more we gaze up into heaven, the more do we feel our gaze foiled. All attempts to explore heaven's infinite gladness are baffled by something like infinite sadness;" but turning to the world around us, the tangible realities of life with which we come into daily contact, we find a fascination in research for the hidden reasons of things, an appetite for the acquirement of knowledge and the attainment of truth that grows by what it feeds upon.

"The truth is mighty, and will prevail;" and chemists have this great axiom prominently brought before them at every turn. Under certain conditions, certain results inevitably follow. If the results are not obtained, the conditions have not been observed. However sincere you may have been in endeavoring to establish them, your sincerity counts for nothing if you have not actually brought about the desired conditions.

Chemistry takes no motives into consideration, makes no allowances for ignorance of her laws. The child who innocently drops a spark upon a mass of gunpowder as inevitably brings about an explosion as the anarchist who artfully contrives his death-dealing bomb.

These laws already exist, and we are unconsciously carrying them out every moment of our lives. When known and taken advantage of, they serve the best interests of the race. When neglected and disregarded, they carry out their fulfilment regardless of our weal or our woe. It rests with yourselves which course you will pursue. Take up the study of the sciences, and you will find a world of new ideas, a wealth of knowledge, opened out before you which only awaits an earnest effort on your part to make a source of recreation, entertainment, improvement, and gain, both in the estimation of the world, and in a knowledge of the beauty of the wisdom of God.

[1] From a lecture delivered before the Young Men's Institute of the Young Men's Christian Association of the city of New York.

ASTRONOMY was cultivated in Egypt and Chaldea 2800 B.C.; in Persia, 3209; in India, 3101, and in China, 2952.

ARISTOTLE founded the science of botany about 347 B.C.

SCIENTIFIC BREVITIES.

A PETRIFIED SEA-SERPENT. — Off the Lizard coast, in Cornwall, a freak of nature has been rediscovered which may have something to do with the name of that part of the coast. In the live rock is a picture of a gigantic serpent, coil after coil reaching down to the sea, just above the surface of which the scaly head, and even the eyes, can be seen.

LIGHTNING-FLASHES. — W. Kohlrausch has estimated the current and quantity of electricity in a lightning-flash. He calculates that it will take 9,200 ampères to melt a copper rod of 2.5 centimeters diameter. Such a current, concentrated in a flash, would contain from 52 to 270 coulombs, which would decompose from 5 to 25 milligrams of water, and form 9 to 45 cubic centimeters of explosive gas. If this energy were stored up, and distributed for electric-lighting, it would require from 7 to 35 flashes to keep one incandescent lamp lighted for an hour.

COBALT. — One curious discovery of M. Berthelot is, that the accepted etymology of *cobalt* is questionable. It is generally believed that the word is of German origin, referring to the demons which were credited with the difficulties in the working of cobaltiferous ores. Cobalt blue has, however, been found in Greek and Roman antiquities and Egyptian beads; and M. Berthelot calls attention to a passage in the *Lexicon Alchemiæ Rulandi*, "*Cobaltorum fumus est kobolt*," and finds the same expression in a passage cited by Olympiodore in his Greek text. There has, then, been a probable confusion between an ancient Greek word and a German one, notwithstanding that the precise sense of the modern word "cobalt" is different from that of its progenitor, which referred to a sulphurous arsenical mineral.

A FURY OF THE CHEMICAL WORLD. — "The fury of the chemical world," says Mr. Mattieu Williams, "is the element fluorine. It exists peacefully in company with calcium in fluor-spar and also in a few other compounds; but when isolated, as it recently has been by M. Henri Moissan, is a rabid gas that nothing can resist. It combines with all the metals, explosively with some; or if they are already combined with some other non-metallic element, it tears them from it, and takes them to itself. In uniting with sodium, potassium, calcium, magnesium, and aluminium, the metals become heated, even to redness, by the fervor of its embrace. Iron-filings, slightly warmed, burst into brilliant scintillations when exposed to it. Manganese does the same. Even the noble metals, which at a melting-heat proudly resist the fascinations of oxygen, succumb to this chemical siren at moderate temperatures. Glass is devoured at once; and water ceases to be water by contact with this gas, which, combining with its hydrogen, at the same moment forms the acrid, glass-dissolving hydrofluoric acid, and liberates ozone."

CRYSTALLIZED PHOSPHORUS. — Mr. Herman recently brought before the Society of Chemical Industry some exceedingly curious specimens of phosphorus crystallized by slow sublimation in closed tubes from which the air had been extracted. The forms of the crystals belong to the cubic system, like those of the diamond; and they are, like the latter, formed of a very large number of facettes. Their action upon light is also similar to that exerted by the diamond; so that the crystals of phosphorus, small as they are, give out all the colors of the spectrum with great brilliancy. They are, in fact, like miniature diamonds. When exposed to the light, they become covered with an opaque red coating.

Practical Chemistry and the Arts.

TANNING.

The art of tanning is a very ancient one. It is rather singular that mankind should have discovered the peculiar action of the constituents of bark upon the skin of animals at so early a period, and it is hard to guess what fortunate accident first showed the superiority of leather over the natural hide.

The change of raw hide into leather is both a physical and a chemical one. The tannin, or tannic acid, which is present in the bark of certain trees, unites chemically with the gelatine in the skin, forming a tough, insoluble compound. A decoction of nutgalls poured into a solution of gelatine in warm water will give an abundant precipitate of this substance.

A similar compound is formed when milk is poured into a cup of tea, the tannin present in the infusion uniting with certain nitrogenous constituents of the milk. This change in the chemical nature of the gelatine of the raw hide also changes the physical character, renders it soft and pliable, and prevents the fibres from agglutinating together.

The hides undergo several preparatory processes before they are ready to be tanned. They are first soaked for several days in water containing some carbolic acid to render them soft, while the acid prevents putrefaction in the subsequent processes. They are next placed in vats filled with a mixture of slaked lime and water. This removes the fat, and loosens the hair, which is afterwards shaved off with a blunt knife. To do this with greater ease, the hides are placed upon a cylindrical piece of wood inclined at an angle towards the workman, and called the "tanner's wooden leg." It occupies the same position, and at a little distance resembles an artificial leg held out before him by the tanner.

After carefully removing the hair, flesh, and superfluous portions of the hides, they are placed in what is known as the "sour-bath." This varies in composition, but is essentially a liquid which has fermented or soured, and become charged with weak acid. European tanners use for this purpose a liquid made by boiling waste malt, bran, etc., in water. This bath removes the lime, and causes the hides to swell.

The bark of the oak-tree is preferred for tanning purposes; but that of the hemlock is cheaper, and is extensively used. The leaves and stems of the sumach-tree are also used.

The tanning takes place in large tanks or vats sunk into the ground. The hides are placed in them along with chips of ground bark, and the vats filled with an extract made by boiling the ground bark in water. Here they remain for several weeks or months, the bark and extract being renewed from time to time. Formerly a year or more was allowed for the conversion of the hides into leather; but at present a much shorter time is considered sufficient, although the quality of the leather is apparently the worse for the enhanced speed of the process. After the tanning process is complete, the leather is taken from the vats, washed and dried, and is ready for the oiling and dressing of the currier.

There are other methods of tanning, which are used for the lighter and finer kinds of leather, although the chemical change is quite different from that produced by tannic acid. Chief among these is the process of "tawing," in which alum is used. The salts of aluminium seem to unite with the fibres of the skin, forming a leather closely resembling that produced by the older method. Hides can also be converted into leather by thoroughly saturating them with oil. A part of the oil combines directly with the skin, while the excess is afterwards removed. Wash-leather, or "chamois-skin," is prepared in this manner. The peculiar odor of Russia leather is due to an oil distilled from birch wood with which the leather is treated after being tanned with bark in the usual way.

Recipes for quickly tanning the skins of small animals are often offered for sale by peddlers and peripatetic adventurers. They are usually simply variations of the alum process, or else some worthless mixture of acids which temporarily renders the skin soft, only to subsequently cause its complete destruction.

AN ELECTRICAL-CURRENT METER.

A new method of measuring a current of electricity has been devised by Professor George Forbes. The accurate measurement of the amount of electricity supplied for lighting or other purposes has been an important and difficult problem. The apparatus of Professor Forbes is extremely simple in principle, although there were many mechanical difficulties necessary to be overcome before a practical meter could be produced.

The action of the meter depends upon the heating power of the electric current. Before passing into the lamp or motor, the whole or part of the current passes through a flat, horizontal coil of wire, above which is suspended a little wheel provided with inclined vanes like a miniature windmill. As the coil becomes heated by the current, the hot air rises, and sets the wheel in motion; and the number of revolutions, which are proportional to the amount of electricity used, are registered by gear-wheels connected with it, the same as in an ordinary gas-meter. Variations in the strength of the current heat the coils more or less, and cause the registering-wheel to turn faster or slower. Unlike all other meters, it is adapted to measuring alternating currents of electricity, in which the direction is reversed many times a second, as well as the currents which flow continuously in the same direction.

The instrument is certainly a most ingenious one, and, if found to be practicable for general use, will be an important addition to the list of modern electrical inventions.

The art of paper-making has reached a point where a growing tree may be cut down, made into paper, and turned out as a newspaper, all within thirty-six hours.

A NEW LECTURE APPARATUS FOR DEMONSTRATION OF REFLECTION AND REFRACTION.

The apparatus of which a brief description is here offered, is so simple, and in every particular so much more convenient than any other designed for the same purpose, that the writer deems it worth bringing to the attention of his fellow-teachers in physics.

The refracting medium is a hemi-cylinder of crown glass, carefully polished, and mounted so as to turn on its axis horizontally. The radius is 2.5 centimeters, the length 5 centimeters. The axis passes through the centre of a circle of white card-board, whose radius may be 20 centimeters, or 30 centimeters. Each of its quadrants is graduated from 0° to 90°, as shown in the diagram, the diameter connecting the two zero-points being perpendicular to the face of the hemi-cylinder. From a horizontal slit in front of the lantern, a beam is sent through the middle of the glass, and focussed on the zero-point at the farther edge of the card-board, whose plane has been slightly inclined so that the path of the beam is sharply defined upon it. The incident, reflected, and transmitted beams are in the same line, the angle of incidence being zero.

The hemi-cylinder is now rotated through any

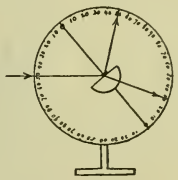


Fig. 1.

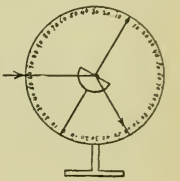


Fig. 2.

desired augle, for example 50°, as shown in Fig. 1. The card-board moves with it. The room should be but slightly darkened, so that there may be no difficulty in reading the graduation on the circle. Part of the beam is reflected, and part refracted. Both are plainly seen, and the angles of reflection and refraction are measured. Varying the angle of incidence from 0° to 90°, one readily observes that the ratio of the reflected light to the refracted light decidedly increases. Turning still further, the beam from the lantern strikes normally on the curved surface, and is totally reflected within the glass at its plane face (Fig. 2). Rotating still further, the re-appearance of the refracted beam announces the critical angle, which is read upon the circle.

In the common form of apparatus where a beam is deflected by a mirror, then sent through smoky air and cloudy water, new adjustments are necessary for every variation of the angle of incidence, involving some trouble and loss of time. With the hemi-cylinder, but one easy adjustment is needed for all. The higher refractive index of glass is an additional advantage, aside from the superior definition. The expense is scarcely more than that of having the hemi-cylinder made by a practical worker in glass. A small silvered mirror is substituted for the hemi-cylinder if the law of reflection alone is to be exhibited. — W. LeConte Stevens, in *American Journal of Science*.

AN EASY METHOD OF FINDING THE SPECIFIC GRAVITY OF LIQUIDS.

A new application of an old rule has suggested a method of finding the specific gravity of liquids which I have never seen mentioned, and which, from its simplicity and great ease of application, seems worthy of publication. By means of it the

specific gravity of any liquid can be ascertained without calculation or any apparatus other than a good balance and accurate weights.

It is known that the weight of a body is to its specific gravity as its loss of weight when immersed in a liquid is to the specific gravity of that liquid. For example, 200 grains of citric acid (specific gravity, 1.60) lose in weight 115 grains when weighed in oil; and as 200 is to 1.60, so is 115 to 0.920, the specific gravity of the oil. Now, if we make the weight of the citric acid the same number of grains as its specific gravity, our formula becomes, as 1.60 is to 1.60, so is the loss in weight of the citric acid when weighed in oil to the specific gravity of the oil; or, in other words, the loss of weight is equal to the specific gravity, from which we deduce the following general rule: —

The specific gravity of the liquid is equal to the loss of weight (in grains) sustained by a solid body when immersed in the liquid, the weight of the solid being equal (in grains) to its specific gravity.

Hence it is necessary only to weigh the solid in the liquid, and its loss gives at once the specific gravity of the liquid.

Taking the preceding example, if 200 grains of citric acid lose 115 grains, 1.60 grains will lose 0.920 grain; and this loss is equal to the specific gravity of the oil.

In practice the weight of the solid might be ten or a hundred times the weight of its specific gravity, care being taken to put the decimal point in the right place in the final result.

As perhaps one of the most desirable solid bodies to use, I would suggest a piece of aluminium weighing 256 grains, the specific gravity of that metal being 2.56. If, upon trial, its specific gravity should vary from these figures, its weight should be made to correspond.

For liquids having greater specific gravity than 2.56, it would be necessary to use a heavier solid than aluminium. — ALFRED B. TAYLOR, *in American Journal of Pharmacy.*

THE STOLEN SECRET OF MAKING CITRIC ACID.

THE following anecdote is told in the *English Mechanic:* There used to be, close to Temple Bar in London, an old chemist's shop. The proprietor of it, in days gone by, enjoyed the monopoly of making citric acid. More favorably circumstanced than other secret manufacturers, his was a process that required no assistance. He employed no workmen. Experts came to sample and assort and bottle his products. They never entered the laboratory. The mystic operations by which he grew rich were confined to himself. One day, having locked the doors and blinded the windows sure, as usual, our chemist went home. A chimney-sweep, or boy disguised as such, wide awake in chemistry, was on the watch. Following the secret-keeper so far on his way to Charing Cross as to be sure he would not return that day, the sooty philosopher hied rapidly back to Temple Bar, ascended the low building, dropped down the chimney-flue, saw all he wanted, and returned, carrying with him the mystery of making citric acid. The monopoly of the inventor was gone. A few months after, and the price was reduced by four-fifths. The poor man was heart-broken, and died shortly afterwards, ignorant of the trick by which he had been victimized. Like Miss Tabitha Bramble when informed that the thunder had spoiled two barrels of beer in her cellar, he might have said, "How the thunder should get there when the cellar was double-locked, I can't understand."

VERIFYING GRADUATED GLASS TUBES.

M. BERTHELOT describes (*Compt. Rend.*) a method employed by him in verifying the graduation of glass tubes employed in gas analysis, which is, however, equally applicable to any graduated tube or burette.

The author fills the tube with mercury when in an upright position, the closed end being downwards, until it overflows, taking care that no air-bubble is introduced. A small, flat piece of glass, rather thick, is pressed down upon the open end of the tube, which is then inverted. The whole — tube, mercury, and glass plate — is then weighed on a balance sensitive to 0.01 gram or beyond. When this is done, the arrangement is taken out, and placed above a small capsule, and one corner of the glass plate is raised slightly, so as to permit a certain quantity of air to enter, and a corresponding quantity of mercury to escape. The contact of the plate and tube is re-established, the arrangement is placed upright on a large horizontal plane, and the graduation corresponding to a horizontal plane tangential to the surface of the meniscus is read off with a lens. He then weighs, as may be most convenient, either the mercury which has escaped into the capsule, or the entire system formed by the tube, the mercury, and the plate, which gives the mercury escaped by difference. This weight, divided by the exact density of mercury at the temperature of the experiment, furnishes with great precision the volume of the entire space now occupied by air and limited to the graduation. In this manner the graduation of any tube may be verified, and a table of correction drawn up.

AN EXPERIMENT TO ILLUSTRATE QUANTIVALENCE.

LEPSIUS has contrived a lecture apparatus for demonstrating the valence of the metals, based upon the method adopted by Nilson and Petterson to determine the atomic weights of the rare elements; i. e., heating a weighed quantity of the metal in dry hydrogen-chloride gas, and measuring the hydrogen set free. In a combustion tube 40 centimeters long, pieces of thallium, of zinc, and of aluminum are placed, about 10 centimeters apart; the weight in each case corresponding to double the atomic weight in milligrams: i.e., 408 milligrams thallium, 113 milligrams zinc, and 54 milligrams aluminum. The hydrogen chloride is evolved by the action of strong sulphuric acid on a piece of ammonium chloride, and is carefully dried by passing it through sulphuric acid. The hydrogen is collected in an apparatus like a Hofmann apparatus for decomposing water, but which has three graduated tubes, the whole rotating in a socket containing mercury, so that the gas may be sent into either of the tubes at will. The three tubes are filled with a dilute soda solution. In performing the experiment, the thallium is first heated with a Bunsen burner, and the hydrogen collected in one of the three tubes. Then the zinc is similarly heated, and after that the aluminum; the evolved gas being collected in the second and third tubes. The hydrogen in the first tube will occupy 22.32 cubic centimeters; that in the second, 44.62 cubic centimeters; and that in the third, 67.86 cubic centimeters: the ratio of the three being 1: 2: 3, or that of the valence of the metals used. — *American Journal of Science.*

LABORATORY NOTES.

ESTIMATION OF POTASSIUM IN PRESENCE OF SULPHATES. — E. Bauer recommends to determine first the quantity of sulphuric acid in the sample, and then to add the equivalent quantity of baryta solution. The filtrate is then fit to be tested for potassium with platinic chloride.

BISMUTH TEST. — Mr. F. B. Stone states that bismuth in very dilute solution, with a very minute amount of free sulphuric acid, with a strong solution of potassium iodide dropped into it, produces a bright-yellow color, and that this reaction will show when the bismuth salt is only one part in a million.

A QUICK FILTER. — Take a clear piece of chamois skin, free from thin places; cut it of the desired length; wash it in a weak solution of salsoda or any alkali, to remove the grease, and rinse thoroughly in cold water before using. Tinctures, elixirs, sirups, and even mucilages, are filtered rapidly. A pint of the thinnest sirup will run through in four or five minutes. By washing thoroughly after each time of using, it will last a long time.

A NEW SUPPORT FOR FUNNELS. — Mr. Meurer describes a new support for funnels while drying. It is made in the following manner: Two horizontal parallel bars of glass tubing are supported by pieces of glass rod which have their ends bent upwards till they nearly meet, and thrust into the ends of the tubes, which are bent downwards at right angles. A small hook of glass rod prevents the bars from springing apart under the weight of the funnels which rest between them.

PORCELAIN SHOT. — Under this name small white globules of porcelain are made in Munich. They are made to take the place of ordinary lead shot used for cleaning wine and medicine bottles, as porcelain is entirely free from the objection of producing lead contamination, which is often the resul when ordinary shot is used. Their hardness and rough surface, producing, when shaken, greater friction, adapt the porcelain shot well for quickly cleaning dirty and greasy bottles; and, as they are not acted upon by acids or alkalies, almost any liquid can be used.

A NEW SOURCE OF HYDROGEN GAS for experimental purposes has been pointed out. It consists of powdered slacked lime and iron filings. When these two substances are intimately mixed and heated to redness in a proper container, a very considerable amount of hydrogen is evolved. The only precaution necessary is, to use a vessel so shaped that the water of condensation will not fall or flow back upon the material. For experimental purposes a strong soft-glass tube, with a bulb blown at one end, answers very well. The open end must be directed downward in such manner that the condensation water will be carried off, as noted above. From 20 grams of an equal mixture of lime and iron filings, Stolba obtained, in the course of twenty or thirty minutes, 1,230 cubic centimeters of hydrogen.

CURIOUS FORMATION OF CRYSTALS. — If a lump of pure granulated chloride of ammonium be carefully introduced into a solution of nitrate of lead, best in a wide-mouthed bottle, there will soon appear pillars of crystals, resembling in some respects the amorpho-crystalline appearance of commercial starch, or, more accurately, angular snow-banks. The result is very beautiful, but, besides, affords an excellent opportunity to notice the mode of formation. The minute crystals of chloride of lead will be seen to rise from all sides, at the base of the forming pillars, and, ascending above their summits, will describe an inward curve, and fall on top. The process being continued, the pillars will rise rapidly. This is interesting as bearing on the causes of crystalline form. If commercial fibrous chlorides of ammonium be used instead of that described, the result is extremely remarkable from an artistic point of view, but does not show the currents so distinctly.

Home, Farm, and Garden.

THE CHEMISTRY OF A MATCH.

Although there are many people now living who can remember the time when there were no matches, and the uncertain and inconvenient flint and steel was the only means of obtaining fire, yet the inventor of the useful friction match remains unknown. Like many other great inventions, it is claimed by several different persons.

The most important substance used in the manufacture of matches is phosphorus. This singular element was first discovered in 1669, by Brand, a German chemist. It takes its name from two Greek words signifying the *light bearer*, owing to its property of shining in the dark. It was formerly only made in very small quantities as a chemical curiosity; but, on account of the rapid growth of the match-making industry, many tons are now annually produced, principally from the phosphate of lime contained in bones.

Its most valuable property is its intense affinity for oxygen, and the ease and rapidity with which it unites with that element, causing combustion. It slowly oxidizes in the air at ordinary temperatures, giving off luminous fumes in the dark, and at 167° F. it ignites. This comparatively low temperature — less than that of boiling water — can readily be attained by friction, and upon this fact the usefulness of matches depends.

It is a well-known fact, that, when bodies are rubbed together, heat is produced. The heat developed in the journal of a railroad-car is frequently sufficient to set the packing on fire; and certain savage tribes who are ignorant of flint and steel, obtain fire by rubbing two pieces of wood briskly together. In such cases no heat is created, — it is only motion transformed. The heat which sets the packing of a "hot box" on fire, comes as truly from the coal burning in the furnace of the engine, as if a burning coal had been taken and applied directly to it. The only difference is, that the effect is more indirect. The heat of the burning coal is transformed into motion by the locomotive, and the motion is converted back into heat by the friction between the axle and journal-box. The heat which the savage obtains by rubbing the wood together, is first developed in his body by the oxidation or burning of his food, then is changed into the muscular energy which he applies to the rubbing, and finally appears as heat again in the igniting wood.

It will thus be seen that the principle of friction is used in all the ordinary methods of obtaining fire, and it is only in the amount required that the modern methods are superior. The friction between the flint and steel is less than that between the two pieces of wood, and the amount of heat required to ignite a particle of phosphorus is so small that a mere touch will suffice.

When phosphorus burns, it is converted into a white solid substance known as phosphoric anhydride (P_2O_5). This is readily fusible, and coats every thing in its vicinity with a sort of glaze, which prevents further combustion. This would prevent the wood of the match from readily igniting, so it is first dipped in melted sulphur. Sulphur being quite inflammable, only a very minute amount of phosphorus is necessary, which will not produce enough phosphoric anhydride to interfere with its ignition. The flame of the burning sulphur which only gives off a gas (sulphurous anhydride), is readily transmitted to the wood, and the match is fairly lighted.

A variety of phosphorus known as amorphous phosphorus is used in the manufacture of safety matches. This has the same chemical composition as ordinary phosphorus, but possesses very different properties. It will only ignite at a temperature of 572° F. When mixed with chlorate of potash, however, it easily explodes. Safety matches are tipped with a combustible mixture containing chlorate of potash; and the amorphous phosphorus is spread upon one side of the box, forming the igniting surface. When the match is rubbed against it, the chemical combination takes place, and the match is ignited. In this case the fire is not produced entirely by friction, but by the chemical action between the amorphous phosphorus and the chlorate of potash.

Matches have been made without using phosphorus; mixtures of chlorate of potash, sulphide of antimony, and peroxide of lead, being substituted: but they are inferior to those containing the more fiery element, and have never come into general use.

THE EDELWEISS.

The Edelweiss, or "noble white" (*Gnaphalium Contopodium*), is a beautiful little pearly-white flower growing upon the Alps and Pyrenees, at an altitude of about six thousand feet. It is much sought after by Alpine mountaineers, and is proudly worn by the adventurous climber as a badge of daring and bravery. Unfortunately, however, it is extensively collected and sold by the Swiss peasants; so that many a traveller, with his hat picturesquely decorated with a bunch of the flowers, may never have made a mountain expedition involving more danger than a trip over the Rigi Railway, or a carriage-ride over the Simplon Pass.

The practical Germans also make a very perfect imitation of the Edelweiss out of cotton-wool, which doubtless answers the purpose of the average Alpine tourist just as well as the original flower.

Like many other Alpine flowers, the demand for specimens is so great that it is becoming scarce, and is in danger of extermination. In order to avoid this undesirable result, a botanic garden has been founded in Geneva, where all the rarer Alpine plants are preserved, and specimens supplied to botanists and collectors.

The Edelweiss can be cultivated in pots, or among rockwork; but it is said that when transferred to a lower level, its blossoms sometimes become red. Among the Swiss mountaineers it is considered the emblem of purity, and is used as a bridal flower in place of the orange-blossoms of more temperate climes. An allied species, the *G. Supinum*, is found on the summit of Mount Washington and a few of the highest peaks of the White Mountains. The common cudweed, or everlasting, also belongs to the same family.

HOPS.

The hop-plant is, in many sections, a crop of great importance. Its principal use is to impart a bitter flavor to beer and ale, though its active principle, lupulin, is used to a considerable extent in medicine. It is a graceful and handsome vine, and is sometimes cultivated as an ornamental plant; but it tends to grow coarse and ragged in the latter part of the season.

The hops themselves are the catkins of the

female or pistillate flowers. At the base of each flower is seated the pistil, containing the ovule, or immature seed; while surrounding the pistil are a number of little grains, which consist principally of the lupulin, or active principle. The grains are embedded in a yellow powder containing an essential oil, which gives to the hops their peculiar flavor. Air-dried hops contain about 0.8 per cent of this oil. In old hops the oil is sometimes oxidized into valerianic acid, which is the cause of the cheesy odor they often possess. Hops also contain from two to five per cent of tannic acid. This is useful in brewing, as it precipitates the albuminous matters of the malt, and serves to clarify the beer. The lupulin, which must not be confounded with the essential oil, occurs with a resin known as hop resin. It is soluble with difficulty in pure water, but dissolves to a considerable extent in the beer.

The quality of beer is largely dependent upon that of the hops. They require a rich soil and a sunny exposure. They must not be gathered until the seed is perfectly ripe, as only then are the lupulin and oil fully developed. They are carefully dried at a temperature of about 100° F., and packed in bags. They are sometimes subjected to the vapor of burning sulphur, to preserve them; but the practice is an objectionable one, especially as old, inferior hops are occasionally treated in the same way, to give them the appearance of freshness.

The medicinal principle of hops, lupulin, possesses narcotic and sedative properties, and is considerably used where such effects are indicated. A "hop pillow" is an old-fashioned remedy for sleeplessness, and every farmer's wife knows the virtue of a hop poultice. In England there is a superstition that the dust from freshly gathered hops, falling into the mouth, is a cure for consumption. Charles Dickens, who lived in a hop-growing district, speaks of the number of death-stricken consumptive wretches who, joining the gangs of hop-pickers, and "sleeping in the fields, amid the dew and damp, get well surely and speedily."

Many substitutes for hops have been employed for flavoring beer, such as wormwood, aloes, quassia, and picric acid. It is said that strychnine is sometimes used for the purpose, but this is probably untrue. All the substances mentioned above are inferior to hops, and their use constitutes an adulteration. Hops themselves are not especially injurious; and if the same could be said of the alcoholic constituent of beer, there would be little objection to its general use as a nutritious and wholesome beverage.

A "ROAST OF RUBBISH."

A correspondent of *The Farm and Fireside* says:—

"I have just finished my annual 'roast of rubbish.' Upon a foundation of pieces of partly decayed rails and sticks of timber, arranged in the form of a grate, and placed in a convenient spot of the back-yard, a fire was kindled, and fed with the trimmings of fruit-trees, great quantities of leaves, weeds, sticks, chips, corn-cobs, and other materials too numerous to mention, — largely the proceeds of a thorough overhauling and raking-over of the various yards. A lot of cast-off boots and shoes, old bones, and many bushels of oyster-shells were gradually added to the heap when in full blaze, and the moister part of the rakings and rubbish was reserved for placing on the outside of the great mass of fire, as a cover and damper, to prevent over-rapid and complete combustion. The heap kept smouldering for several days and nights. The burnt oyster-shells around the outside were gradually slacked by repeated rains and occasional applications of water from the garden sprinkler, while the inside yet remained a red-hot, glowing mass.

"What is the result of all this? For one thing, the premises had a thorough cleaning, and every thing around the house and in the yards — henyard included — looks 'as slick as a whistle.' This is one advantage. The other is more substantial; namely, fifteen wheelbarrow loads of a most valuable fertilizer and insect repeller, consisting of a fine quality of unleached ashes, shell lime, burnt bone, soot, charcoal, etc., the whole impregnated with creosote, and rank with the smoky odor so repulsive to insects. Where this material is freely incorporated with the soil, few insects will care to come or stay, while plant-growth is especially healthy and thrifty. Sift the fine dust over radishes, turnips, cabbage, etc., and the jumping striped flea-beetle will bid you good-by at once. If I cannot succeed in raising radishes that are free from the maggot any other way, I never fail to do so when applying a generous dose of the 'roast of rubbish' to the soil before sowing the seed. But it is a powerful fertilizer, and should be well mixed with the soil, or applied as a top-dressing around the plants. Too much of it should not come into actual contact with them, as it is liable to scorch them. I cart it to the garden as wanted, and put a small shovelful around the melon, squash, and cucumber vines, the egg and tomato plants, etc. It does good wherever put.

"Every farmer can make such a 'roast,' and most of them even larger and more valuable than mine. Not everybody has oyster-shells to dispose of in this way, 'tis true; but they are not indispensable. Save all the bones from the household dead poultry or other farm animals. There is always plenty of rubbish accumulating in the course of a season: all this should be gathered, and utilized for the great annual *auto-da-fé*."

WHAT THE COW GIVES US.

American dairy interests are startlingly enormous. They represent an investment of nearly twenty-five times the entire bank capital of the country; that is to say, the bank capital is a little less than $971,000,000, while the dairy interests amount to more than $3,000,000,000.

Of course our readers cannot swallow such frightful figures in a lump, and we will therefore arrange them in several smaller, but still heroic, doses.

The number of milch-cows is estimated at 21,000,000. They give each an average of 350 gallons of milk annually. This would make an aggregate milk production of 7,350,000,000 gallons, a miniature ocean, a fair sized-Niagara. Four thousand millions are used for cheese, and the remaining 2,650,000,000 pass through the adulterating hands of the milkman and grocer, and down the throats of 60,000,000 men, women, and babies in this land of freedom.

The quantity of butter manufactured and used is about 1,350,000,000 lbs., and of cheese 6,500,000 lbs. The value of our dairy products for the last year was nearly $500,000,000. This is $20,000,000 more than the value of our annual wheat-yield; while it closely approximates that of our corn-crop, which is the most valuable of our farm products.

To support this immense dairy-herd, 100,000,000 acres of pasture-land are required, worth $250,000,000. It is easy enough to see, therefore, that the 4,000,000 farmers in this country are an important element of our national welfare and prosperity. — *Holstein-Friesian Register*.

HORTICULTURAL HINTS.

Gardening is the handmaid of civilization; the more enlightened a people become, the more do they study the securing of better health, comforts, and luxuries. Horticulture provides these.

Handsome Foliage. — The experience of some horticulturists is, that blooms are at the expense of fine foliage. Particularly is this the case with the fancy-leaved geraniums. Coleuses lose in beauty if permitted to seed.

Hedges of Roses have been adopted on some European railways to screen the lines from drifts of snow, and thus prevent blocking. They have proved immensely serviceable.

Rain-Proof Flowers for the Autumn. — A correspondent of the *Horticultural Times* writes, "If I had space, I could make out a fairly long list of subjects suitable for flowering in the autumn; but here is a list of three that will disappoint no one if they grow them well. The first is *Rudbeckia Newmani*, a hardy herbaceous plant, the flowers of which are composed of a single ray of golden florets encircling a black disc, a very striking plant in a mass, which neither wind nor rain injures. The purple sage (*Salvia-herminum*) is another plant that defies wind and rain. The flowers are insignificant, but the purple spots which are formed at the points of the shoots is the part which furnishes the color. It is an annual, and is well adapted for growing in masses. My next favorite autumn flower is *Tagetus Signata Pumila*, a well-known form of dwarf marigold, with golden-yellow flowers. Everybody should grow plenty of this if they want a bright garden in the autumn."

Heliotrope Flowers in Winter. — The heliotrope with fair management is one of the most profuse and steady flowering-plants for either the window or conservatory. It may be had in bloom every month. To have a supply of winter and spring bloom, the plants should have been started from slips in June. They should soon after have been given three-inch pots, and a place in full air until the approach of frost. During the summer interval they require frequent stopping, for inducing the usually preferred low bushy form, with an abundance of flowering shoots. An occasional shift should also be resorted to, remembering, however, that rather close root quarters is a gain. During the flowering stage the plants should have from 50° to 60° of heat; and about once a week, or when in full bloom twice a week, they may with benefit receive liquid manure at the roots. The plants, like the flowers themselves after cutting, do better for not being crowded together or with others. In dealing with that common pest of such plants, the green-fly, care must be taken that the foliage be not injured with the usual remedy, — tobacco-smoke. This remedy may with safety be applied in moderately strong volume if the simple precaution of syringing or otherwise completely wetting the foliage just previous to starting the fumigation is observed, otherwise the plants would be liable to become badly burned. The heliotrope delights in a compost consisting of three parts of fresh loam or decayed turf to one part of rotted manure, with a good sprinkling of sharp sand added.

The Popular Science News.

BOSTON, SEPT. 1, 1888.

AUSTIN P. NICHOLS, S.B. . . . . *Editor*
WILLIAM J. ROLFE, LITT.D. . . . *Associate Editor*

THE perennial Keely with motor attachment has bobbed up serenely once more with a new application of his "etheric force." He now uses it as a "disintegrator;" and by holding his machine in his hand, and pressing it lightly against a piece of auriferous quartz, the mineral is at once reduced to an impalpable powder, leaving the gold contained in it, in the form of easily separated grains. A fascinating newspaper article relates how Mr. Keeley accompanied a "syndicate of solid capitalists" to the Catskill Mountains, and, in exactly eighteen minutes, bored a tunnel twenty or thirty feet in length into a solid ledge of rock. The article further relates that the capitalists were so moved by this proceeding, that they showered unlimited funds upon the inventor, to enable him to carry on his experiments. Of course this story is entirely imaginative; but it is a fact that certain persons still believe in the invention, and are furnishing the inventor with money. It would seem as if the proverb ought to be changed so as to read, "A syndicate and its money are soon parted."

AN unusually high tide recently occurred in Boston Harbor, at the time of a new moon; and a leading daily paper the next day gave the remarkable explanation, that it was due to "the simultaneous rising of the tide and new moon at midnight." Without criticising the remarkable behavior of the new moon in rising at midnight, the "simultaneous rising" of the moon and tide is a delicious piece of absurdity. It would be hard to compress more scientific errors into one sentence than the writer of the paragraph succeeded in doing.

ANOTHER enterprising newspaper of this city, thinking to make a sensation among the medical profession, sent a reporter, who pretended to have certain symptoms of disease, to consult a number of physicians, although in reality he was in perfect health. The symptoms which the reporter selected to afflict himself with, consisted principally of backache and tenderness of the spine. The medical men stood the test remarkably well, nearly all of them diagnosing rheumatism or lumbago, and prescribing the proper remedies therefor. It is no discredit to the skill of a physician, to believe the false statements made by a supposed patient; and if such a person says that he is suffering from certain symptoms, the doctor is bound to believe him, and prescribe for the disease indicated by them. The intended "sensation" can hardly be said to have been an eminent success, as far as the newspaper was concerned.

THE *Electrical Review* recently published an article upon lightning-rods, claiming that they were of no value as a protection against lightning, and that future generations would consider a rod on a house as much a relic of superstition as we should a horseshoe nailed over the door. We think these assertions are altogether too sweeping, and consider a properly applied lightning-rod of great value. It is true that we do not fully understand the laws which govern the passage of a lightning-stroke; but there are too many cases on record where a rod has carried off the discharge without harm, to say that they are of no value whatever. It is a fact, however, that very few rods are properly applied; the most important point, a good earth-connection, being nearly always neglected. Unless this is properly attended to, a rod is of little or no value.

THE "drop-a-nickel-in-the-slot" scheme has reached the gas-companies; and a meter has recently been patented in England, which, when a penny is dropped into it, will allow a certain number of feet of gas to pass into the pipes. When the amount paid for is nearly exhausted, the gas burns low as a signal for another penny. If the warning is unheeded, the supply is shut off altogether. This singular device appears rather ludicrous at first sight, but there are many occasions when a limited supply of gas at a fixed prepaid rate might be found very useful and economical.

DR. GEORGE HAY of Pittsburg, Penn, sends us an account of an analysis made by him of the metal composing a tin can holding preserved fish. He found it to consist of 13.76 per cent of tin, 61.92 of lead, and 24.32 of iron. The large proportion of lead present shows that the material of which the can was made was the *terne* plate which is usually used for covering roofs. As it is supposed that only the pure tin plate is used in making cans for preserving food, this analysis is worthy of notice. Although the terne plate is slightly cheaper than tin, it is a very dangerous substance to be brought into contact with food, and only a criminally careless or reckless person would make use of it in the manufacture of cans. We do not believe, however, that it is generally used, and think the cans examined by Dr. Hay must have been exceptional ones. The large amount of iron present is noticeable, but it was probably removed from the iron plate in scraping off the more fusible alloy with which it was covered.

NEW discoveries in the photographic art continue to be made almost daily, and the sensitiveness of the plates is constantly increasing. Pictures are now taken at night by the light of an instantaneous flash of magnesium powder, which is especially rich in actinic rays. The light from a large variety of South-American firefly has been used to copy a transparency from a negative; and the photographs of a moving pistol-ball, illustrated in the August number of this paper, must necessarily have been taken in an inconceivably small fraction of a second. Photography in natural colors is, however, still an undiscovered art, notwithstanding numerous announcements of its discovery in the newspapers, which are probably due to a misunderstanding in regard to the process of isochromatic photography, or the photographing of different-colored objects in their proper values of light and shade, — a very different matter.

THE statements made by an alleged German scientist about the "gas-caverns" and "oceans of boiling rock," situated beneath the town of Findlay, O., have been telegraphed all over the country, and have caused considerable anxiety to many credulous persons. We can assure our readers who reside in the natural-gas regions, that these statements have no basis whatever in fact, and that it is absolutely impossible for any person to determine what the condition of affairs is so far below the surface of the earth. We do not believe that the "professor" ever made the statements credited to him; but, if he did, he is simply a scientific humbug, with a much larger reservoir of "natural gas" underneath his hat than any that exists below the town of Findlay.

A CURIOUS EXPERIMENT.

TAKE a water-flask, or a wide-mouthed decanter or bottle, hold it in a horizontal position, and place a small cork in the neck. It will then seem an easy matter to blow the cork into the bottle; but upon trial, it will be found almost impossible to do so, as, the

harder one blows, the more forcibly it is ejected *out* of the bottle, and into the face of the experimenter.

The explanation of this peculiar behavior of the cork is very simple. The bottle is already full of air, so that no more can be blown into it; and the only effect produced by blowing, is to compress the air already inside. When the pressure is removed, the air, being elastic, expands again quickly, and, in so doing, forces the cork out of the neck, apparently in a reverse direction to the current from the lungs of the experimenter. The neck of the bottle must be perfectly dry, or the cork will adhere to it, and interfere with the success of the experiment.

AN IMMENSE BOWLDER.

THE accompanying engraving is from a photograph by Dr. Lortet, published in *La Nature*, of an immense block of stone poised upon the surface of the Gorner glacier in Switzerland. It is doubtless a familiar fact to most of our readers, that these glaciers are really rivers of ice in constant motion, flowing down the sides of the Alps and through the valleys. The motion is slow — only a few inches a day at the most — but irresistible; and, as the glacier moves through its rocky channel, its surface becomes covered with dirt, stones, rocks, and all manner of rubbish which fall upon it from above, or are broken off from the sides of the valley by its own movement. Many of these rocks are carried down to the lower end of the glacier, and left heaped up as it melts, forming what is known as the terminal moraine. Others fall into crevasses in the ice, and are ground up into sand and clay by the glacier itself, and carried off in the stream of water which flows from it.

The large block of stone shown in the engraving is a mass of gneiss brought by the glacier from Monte Rosa. It is elevated about one hundred and twenty feet above the general surface of the glacier, owing to an unevenness of the ice. The visible part of the bowlder measures thirty-nine feet in height, thirty-three feet in width, and nine feet in thickness, so that this single stone contains nearly twelve thousand cubic feet. The greater part of the stone, however, is buried in the ice; and a piece of nearly equal size has at some time been split off from it, and is shown in the engraving lying on the rocks below. The original stone, therefore, must have been two or three times larger than the part now visible on the glacier.

The traces left by a glacier as it passes over the surface of the earth are very characteristic. The rounded stones and bowlders, the polishing, grooving, and scratching of the underlying ledges, the immense deposits of gravel, sand, and clay, all show where the glacier has been at work. They can be traced down the Swiss valleys far beyond the points to which they extend at present, and out upon the plains of central Europe. The only glaciers in this country are a few in the northern part of the Rocky-Mountain range; but the evidence is indisputable, that, at some distant period, the entire northern part of the country was covered with moving ice, thousands of feet in thickness. In some places the country is almost covered with bowlders, brought by the ancient glaciers from some distant mountain-side; and in Essex County, Mass., there is one nearly equal in size to the more modern bowlder of the Gorner glacier. These facts seem almost incredible, but they are proved by the strongest evidence; and it is by no means improbable, that, after many thousand years, the same conditions may again obtain, and the ice cover the country once more, as it now covers the land about the south pole of the earth, and many parts of Greenland.

Dr. Nichols, the former editor of this paper, was greatly interested in the study of bowlder-rocks during his life; and a large ice-hewn stone, taken from his farm at Lakeside, now marks his last resting-place.

FERMENTATION.

FERMENTATION is a peculiar process which takes place in organic bodies in which chemical change and decomposition occur under the influence of certain nitrogenous substances known as ferments. The ferments appear, in most cases at least, to possess vitality, and grow and increase in the fermenting substances like plants or animals.

The vinous or alcoholic fermentation is the variety of the most importance. This fermentation takes place in bread-making and the manufacture of beer, wine, and spirits. It consists in the decomposition of starch or sugar into alcohol and carbonic-acid gas, under the influence of an organized substance known as the yeast-plant. Although commonly called a plant, it resembles rather more an animal, inasmuch as it feeds upon complex substances, breaking them up into simpler ones. A man or a horse feeds upon starch, and excretes it in part, in the form of carbonic-acid gas like the yeast; while a plant feeds upon the carbonic-acid, and builds it up again into starch and sugar.

Starch will not ferment directly, but is first converted into glucose, or grape-sugar. This occurs in grain during the process of malting or germination. A substance called diastase, present in the grain, seems to determine this change. Common cane-sugar, or saccharose, is also unfermentable, but must first be changed into grape-sugar, or glucose.

Although yeast is usually introduced artificially into the substance it is desired to ferment, the cells are apparently present in the air at all times, and cause fermentation to take place spontaneously when the fermentable liquid is freely exposed to it. There is an old question, Where did the first brewer get his yeast? which has never been answered; for, although he undoubtedly obtained it from the air, it is hard to say where the yeast-cells present in the air were first developed. The extreme limits of temperature at which the yeast can live are 41° and 86° F., consequently fermentation can only take place between these points.

When yeast is introduced into a liquid capable of fermentation, it begins to grow, and throw out arms, until the surface of the liquid is completely covered. This is known as the *barm*, or surface yeast, while at the bottom of the liquid a viscid sediment known as the bottom yeast is deposited. The surface yeast is used by bakers in raising their bread, and is collected from the breweries daily, compressed into small cakes, and extensively sold to housekeepers under the name of Vienna yeast. The barm is also used by the brewers for the fermentation of the succeeding batch of beer. The bottom yeast produces a slightly different fermentation, and is used in the manufacture of wines, and a variety of Bavarian beer which does not sour by exposure to the air.

It is a curious fact that during fermentation the glucose is not entirely converted into alcohol and carbonic dioxide, but about three per cent of the glucose is changed into glycerine, and 0.6 per cent into succinic acid. It has

also been found that yeast will assimilate tartaric, malic, and even nitric acids, reducing the last to nitrous acid. Truly, the little microscopic yeast-cell is a wonderful organism.

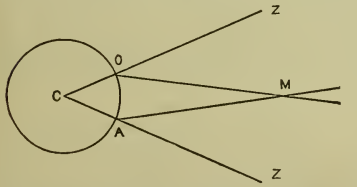
There are several other varieties of fermentation which are not so well understood, and are of but little practical importance. The acetic fermentation, or conversion of alcohol into vinegar, is accomplished by a ferment known as mother-of-vinegar, or *Mycoderma aceti;* but it is a simple process of oxidation, and can be accomplished equally well by inorganic chemical reagents. Lactic fermentation takes place when milk sours, and the sugar contained in it is transformed into lactic acid. Butyric acid is formed in the fermentation of butter; while putrefaction and decay are varieties of the same process, and due, in part at least, to the action of living organisms. Diseases like typhoid-fever, diphtheria, or consumption, in which bacteria are present, may also be considered as a fermentative process going on in the body.

Any substance that will kill the organisms of fermentation will stop the process, and preserve the substance indefinitely. Heat is the safest and best agent for this purpose, and is used to an immense extent in preserving canned provisions. The list of chemicals capable of stopping fermentation is a long one, and includes sulphurous acid, borax, salicylic acid, carbolic acid, corrosive sublimate, thymol, and many others. Some of these are harmless, and others poisonous; but none can be recommended as a wholesome addition to food or drink for daily consumption.

[Original in *Popular Science News.*]

TO ASCERTAIN THE DISTANCE TO THE MOON.

First we require to measure the angle made by a straight line from the point of observation to the moon, and another straight line from the earth's centre passing through the point of observation to the zenith. The visual ray from the observer to the moon will be the first line OM in the figure below. Any perpendicular, as a plummet-line, at O, the point of observation, will exactly coincide with the straight line from the centre of the earth to the zenith, the point in the heavens immediately



overhead. The number of degrees in the angle MOZ must therefore be accurately taken. When that is done, we also know the value of the angle MOC; for that must be the difference between MOZ and two right angles. If we then lay down the lines ZC and MO at the ascertained angles, it is evident that the line OM must pass through that point in the heavens which is occupied by the moon. Now let another observer at A in the same manner ascertain the angles MAZ and MAC. He will then be able to lay down two straight lines ZC and MA. If these are drawn at their proper angles, the line AM must also pass through the point in the heavens occupied by the moon. Now, if these two observers come together, they will be able to construct a four-sided figure MOCA. The two lines OC and AC will represent two radii of the earth. The two lines OM and AM will represent the distance from each observer to the moon. If this figure is constructed accurately, it will be found that MO or MA is sixty times longer than OC or AC. That is, the distance to the moon is sixty times greater than the radius of the earth. The latter being known to be four thousand miles, we have to multiply by sixty, which gives us two hundred and forty thousand miles as the distance to the moon.

B.

[Specially reported for the *Popular Science News.*]

METEOROLOGY FOR JULY, 1888.

TEMPERATURE.

Average Thermometer.		Lowest.	Highest.	Range.
At 7 A.M.	64.29°	57°	71°	14°
At 2 P.M.	75.84°	63°	86°	26°
At 9 P.M.	66.71°	57°	73°	16°
Whole month	68.95°	57°	86°	29°
Last eighteen Julys	71.41°	68.95°, in 1888.	74.80°, in 1887.	5.85°

The entire month was the coolest July for the last eighteen years, being 5.85 less than July, 1887, which was the warmest during this period. July, 1884, was only .01° warmer than the present, — a difference scarcely perceptible. July, 1876, was also very warm, only .44° less than that of 1887. The present July was only .17° warmer than June last, while the average July is 4.52° above that of June. The coolest day the past month was the 1st, with an average of 60⅜°. The 28th was nearly the same, 61°. The 7th was the warmest day, with an average of 76°; the next warmest 74°, on the 11th, which was more than ten degrees below that hottest day in June last. The general range of temperature was less than usual for July, which averages the lowest of any month in the year. The more uniform the temperature, the smaller the range. The temperature of the month was 2.46° below the average of July, and the average since Jan. 1 about 1¼° below the usual for the seven months, keeping the season still backward.

SKY.

The face of the sky in 93 observations gave 53 fair, 21 cloudy, 16 overcast, and only 3 rainy, — a percentage of 57 fair. The average fair for the last 18 Julys has been 62.3, with extremes of 43 in 1887, and 76.3 in 1878. Only three Julys in 18 years have been less fair than the present. We had several very fine summer days. The 3d, and 16th to 18th, were especially noted.

PRECIPITATION.

The amount of rainfall the past month was only 1.20 inch, the smallest amount during the last 20 Julys; while the average has been 2.99 inches, with extremes of 6.85, in 1876, and 1.20, in 1888. This small amount, following the small amount of June, produced no inconsiderable drought, to the injury of vegetation in general, and many fruits in particular. There were severe thunder-showers in the vicinity on the 5th and 11th, but scarcely a trace of rain fell here. The latter occurred at midnight, attended with sharp and almost continuous lightning, heavy thunder, and severe wind, doing some damage. Small amounts of rain fell on the 1st, 19th, and 20th, but little more than sufficient to lay the dust. The principal fall was on the 22d and 23d, yet less than three-fourths of an inch. The whole amount since Jan. 1 has been 29.71 inches (mostly during the first three months), while the average for this period in twenty years has been 27.61.

PRESSURE.

The average barometer the past month was 29.960 inches, with extremes of 30.20 on the 18th, and 29.42 on the 12th, a range of .78 inch. The average for the last fifteen Julys has been 29.922, with extremes of 29.976 in 1887, and 29.820 in 1884. The sum of the daily variations was 3.23 inches, giving an average daily movement of .104 inch. This average in 15 Julys has been .091, with extremes of .118 and .074. The largest daily movements were .40 and .32 on the 11th and 13th, the former in connection with that severe thunder-storm.

WINDS.

The direction of the wind in 93 observations gave 12 N., 1 S., 8 E., 20 W., 8 N.E., 14 N.W., 5 S.E., and 25 S.W., — an excess of 3 northerly and 38 westerly over the southerly and easterly, and indicating the average direction the past month to have been W. 4° 31′ N. The westerly winds have uniformly prevailed over the easterly by an average of 43.37 observations; and the southerly over the northerly, with the one exception of the present July, by an average of 20.74, — indicating the approximate general average direction of the wind during the last 19 Julys to have been W. 25° 33′ S., and showing that the winds the past month have been 30° 4′ more northerly than usual. Hence, too, the cool July. The relative progressive distance travelled by the wind the past month was 38.12 units, and during the last 19 Julys 913.3 such units, — an average of 48.07, — showing more opposing winds the past month than usual.

IN REVIEW.

It may be observed that the present July was the coolest during the last 18 years; had more northerly winds than any in the last 19 years; and less rain than any during the last 20 years; with only three Julys in 18 years less fair than the present. Surely these peculiarities must have had a corresponding influence on vegetation, not favorable to its highest perfection.

D. W.

Natick, *Aug.* 4, 1888.

[Specially reported for the *Popular Science News* from the Observatory of the College of New Jersey.]

ASTRONOMICAL PHENOMENA FOR SEPTEMBER, 1888.

The Planets. — Mercury is an evening star, but is too near the Sun and too far to the south to be easily seen. Venus is also an evening star, and is gradually increasing its distance from the Sun; but it is several degrees to the south, and sets only about an hour after the Sun. Mars is still to be seen; but it now sets between 9*h.* and 9*h.* 30*m.* P.M., and is growing much fainter. It passes conjunction with Jupiter on Sept. 11, the latter being a little more than 2° to the north. Mars is moving somewhat rapidly to the eastward among the stars. Jupiter sets at about 10*h.* P.M. on Sept. 1, and at about 8*h.* 30*m.* on Sept. 30. It is moving somewhat slowly eastward, and on Sept. 22 passes about half a degree to the south of *Beta* Scorpii. The following eclipses of his satellites are visible in the United States during the month. They take place near the planet on the upper right-hand quadrant. D denotes disappearance, and R reappearance. Times are Eastern standard.

I. R. Sept. 1, 9h. 7m. P.M.
I. R. Sept. 8, 11h. 2m. P.M.
II. R. Sept. 10, 8h. 14m. P.M.
III. R. Sept. 12, 7h. 58m. P.M.
I. R. Sept. 17, 7h. 26m. P.M.
III. D. Sept. 19, 10h. 0m. P.M.
III. R. Sept. 19, 11h. 58m. P.M.
I. R. Sept. 24, 9h. 21m. P.M

Saturn is a morning star rising at 2 A.M. at the end of the month. It is moving out of Cancer and into Leo toward the brightest star of the constellation Regulus (*Alpha* Leonis). On Sept. 30 it is about 10° west of this star. Uranus is still an evening star, but is rapidly nearing conjunction with the Sun, and sets too early to be easily seen. Neptune is south of the Pleiades, and rises a little before midnight.

The Constellations. — The positions given hold good for latitudes differing not much from 40° north, and for 10, 9, and 8 P.M. for the beginning, middle, and end of the month respectively.

Cygnus is directly overhead. Delphinus, high up, and Capricornus, low down, are on the southern meridian. Piscis Australis is below Capricornus, and not quite up to the meridian. Aquarius is to the left of Capricornus at about the same altitude. After Aquarius come Pisces and Aries, the latter being almost due east at about 10° altitude. Taurus is just rising a little north of east. Pegasus is between Pisces and the zenith; and Andromeda is above, and a little to the north of Aries. Cassiopeia is to the right, and a little above the pole star. Perseus is low down to the north-east, and Auriga is just rising below it. Draco is to the west of the meridian. Ursa Minor mainly to west of pole star at about the same altitude. Ursa Major is below the pole, a little to the left. Lyra is just to the west of the zenith, with Hercules, Corona Borealis, and Boötes below it, the last being near the horizon a little north of west. Scorpius is setting in the south-west, with Ophiuchus above it. Sagittarius is low down in the south, a little west of the meridian; and Aquila is high up between Sagittarius and Cygnus.

M.

PRINCETON, N.J., *July* 2, 1888.

Correspondence.

Brief communications upon subjects of scientific interest will be welcomed from any quarter. The editors do not necessarily indorse all views and statements presented by their correspondents.

HOW BIRDS LEARN TO SING.

SIR: —

Two of your correspondents in your July issue dispute my assertion that "young birds will never sing the song peculiar to their tribe if they have never heard it," and give instances to prove the contrary. I cannot dispute the facts they adduce; and if it be true that they have reared birds which never heard the song of their tribe, and yet sing it, my assertion must certainly be qualified, though I do not accept their conclusion that birds sing by instinct only, and not by imitation. My assertion was given on good authority, that of such men as the Hon. Dames Barrington (Philosophical Transactions for 1773, vol. 63), and a later authority, Alfred Russell Wallace, the well-known English scientist, and the author, equally with Darwin, of the theory of natural selection. Facts are given the very opposite of those which your correspondents allege to have come under their own observation. I accept both classes of facts, and conclude that birds, like men, differ in their physical and mental powers, and also in the strength of their inherited tendencies. Some birds evidently will not learn the song of their tribe unless they hear it, and some will. Man talks instinctively. Birds sing instinctively. Man talks a particular language or dialect by imitation, not by instinct. Birds learn the song of their tribe by imitation, not merely by instinct. That some birds sing the peculiar song of their tribe without ever having heard it, as is asserted, may probably be explained in this manner: Most animals have a natural voice, which is determined by the form and physical qualities of the larynx. Man talks, birds sing, dogs bark, ducks quack. But birds and men possess more varied vocal powers and greater power of imitation than either dogs or ducks. Man talks, but may talk English or French. The linnet sings, but may sing the song of the lark, or the canary, if it hears one of those, and not its own. A bird reared with no opportunity of hearing the parent's song has the instinct for singing. The form of its larynx, and its inherited qualities, physical and mental, render the parent's song the easiest; as they have rendered that song the easiest, and therefore what is called the natural song, for the tribe. It therefore sings the song it has never heard. In other cases, as my authorities testify, birds do not sing the song of their tribe if they have never heard it. This explanation agrees with both classes of facts. Whether it is correct or not, I accept the facts stated by your correspondents, but I entirely dissent from their arguments and conclusions. The idea that "there can be no similarity between a bird and a man," that the bird is entirely governed by instinct, and man by reason, is an old superstition without the slightest foundation in reason or science. It is a distinction which science does not recognize: it belongs to theology, where it originated. The assumption of an essential distinction between reason and instinct applied to the actions of birds and men, is as unscientific and as untrue as the illustration of your correspondent which is intended to support it, — "no more than meteoric stars establish the course of the planets." Well, they establish the course of the planets, if by those words it is meant that their courses are determined by the same causes, and their curves are of the same character. Exactly the same forces and the same laws which determine the course of a meteor, determine the course of a planet. In either case the curve described must be one of the conic sections: it may be a parabola, hyperbola, circle, or ellipse. The imagined distinction is unreal, like that between instinct in animals, and reason in man, which is an assumption unsupported by evidence, and unrecognized by science. I adhere to the opinion that the singing of birds, like the talking of men, is the result, partly from instinct, and partly from imitation.

Yours faithfully,

SAM'L BRAZIER.

NO. 6 ALLSTON PLACE, BOSTON.

OPTICAL ILLUSIONS.

EDITOR POPULAR SCIENCE NEWS:

I WAS interested in the optical illusions illustrated on pages 97 and 98 of your July number. Like you, I cannot look at them without seeing them constantly in motion; in fact, they impress me as being alive. I wish to call attention to another illusion connected with these figures, which I have never seen mentioned, but which is very curious.

When either Fig. 2 or Fig. 3 on page 98 are rotated rapidly, with the rinsing movement you describe, there appears, within each party-colored circle, a smaller circle of just half its diameter, rolling round its inner circumference, and of a plain slate color, evidently a combination of the black and white divisions. When these segments or divisions are alternately blue and yellow, instead of black and white, the resulting inner circle is green; and so with other colors, the inner circle is a combination of the two. The general explanation of these illusions, I suppose, must be in the fact that impressions on the retina continue for a brief space after the object is removed; but to show exactly *how* these appearances are produced upon that principle, would be difficult indeed.

Very truly yours,

J. P. APTHORP.

TALLAHASSEE, FLA., *July* 30, 1888.

QUESTIONS AND ANSWERS.

LETTERS of inquiry should enclose a two-cent stamp, as well as the name and address of the writer, which will not be published.

QUESTIONS regarding the treatment of diseases cannot be answered in this column.

W. M. I., *New York.* — What can be added to a solution of nitrate of silver to prevent its staining the fingers, and decrease its sensitiveness to light?

Answer. — You can do nothing to prevent nitrate of silver from staining the fingers, except to keep it away from them. The stains can be removed by hyposulphite of soda. Some photographers use the more effective cyanide of potassium, but we would not recommend the use of this extremely poisonous substance.

It is a mistaken idea that pure nitrate of silver is affected by light. Such is the case only when organic matter or other impurities are present. Take a solution of nitrate of silver, and expose it to strong sunlight. It will become black and turbid, but in a short time will clear up, and deposit a black powder which is principally metallic silver. The organic matter has been oxidized at the expense of the oxygen in the nitrate. The chloride, bromide, and iodide of silver are affected by light, and these are the salts used in photography.

H. & W., *New York.* — Has the electric light any bleaching effect upon colors? and, if so, is the arc, or incandescent, light more powerful?

Answer. — We do not think that either form of light would have any appreciable effect. The arc-light is richer in actinic or chemical rays than the incandescent, but probably either kind could be used with safety.

H. W. B., *Chicago.* — Why is aluminium so hard to reduce the metallic state?

Answer. — It is impossible to give a satisfactory reason. It is one of the inherent properties of the element; but *why* it is so, no one can say. Iron is an element closely resembling aluminium in its chemical relations; but, while its oxide is reduced to a metal by simply heating with carbon, the most powerful reducing agents are necessary to separate the oxygen after it has combined with aluminium. Were it not for this strong affinity between oxygen and aluminium, that metal would be as cheap as, or even cheaper than, iron.

LITERARY NOTES.

Elementary Physiography. An Introduction to the Study of Nature. By John Thornton Mack.

Sound, Light, and Heat. By Mark R. Wright.

These two works are published by Messrs. Longmans, Green & Co., New York and London, at eighty cents each. They are written in a popular and easily understood style, and are equally valuable, either as an elementary introduction to a course of scientific study, or for general reading. The volume on Physiography treats of the structure of the earth and the laws and action of the various geological and meteorological forces which act upon it; while the one on Sound, Light, and Heat gives a remarkably good and complete exposition of the phenomena and laws relating to those departments of physical science. The books are fully illustrated, and, at the low price at which they are published, ought to find many readers.

The Octroi at Issoire, by David Starr Jordan, president of the University of Indiana, is published in the August number of the *Popular Science Monthly* of New York. It is a remarkably brilliant satire, and, although written for the purpose of exposing the fallacies of the principles of a protective tariff, will be read with interest and profit by protectionists as well as free traders. We have rarely seen so good an argument for unrestricted commerce.

Pamphlets, etc., received: *Descriptive List of Works on Civil Government*, by the Massachusetts Society for promoting Good Citizenship (Boston); *International Copyright on Works of Art*, by Thomas Humphry Ward; *Some Retrospective and Prospective Thoughts on Surgery*, by Donald McLean, M.D., of Detroit; *Antipyrine*, by Benjamin Marshall, M.D., of San Francisco; *Report of the Managers of the Yale Observatory* and the *Bulletins of the Experiment Stations* of Louisiana and Connecticut.

Medicine and Pharmacy.

[Original in *Popular Science News.*]

ILLUSTRATIONS OF ANTISEPTIC SURGERY.

BY JOHN CROWELL, M.D.

The application of the antiseptic method to the removal of malignant growths has proved satisfactory, when we consider the dubious prospect of success attending such surgical interference. In new growths of a malignant character, there is reasonable hope of complete removal of the disease; and this is a potent reason for justifying the operation.

It is a well-known fact in such operations, that the non-return of the malignant growth depends entirely upon the *complete* extirpation of the diseased mass. Of course, reference should be had to the avoidance of danger to the life of the patient by guarding against mechanical injury, and by limiting the hemorrhage to a minimum. Among the mechanical injuries, — the result of bungling or carelessness, — may be mentioned the habit of tearing the tumor from its adhesions in its capsule; rough handling of cysts; plunging sharp retractors into the tumor. These instruments should be used on the edge of the wound for dilatation, the tumor itself being held with the hand during the entire operation. Lateral tearing and slitting of a large vein is another accident to be guarded against. The rules laid down by Langenbeck must be carefully observed; and should this unfortunate lesion occur in a vein of the size and importance of the deep jugular, the method of procedure, as given by Gerster in his recent and valuable work (p. 55), is worthy of consideration.

In performing important amputations of limbs, the antiseptic method should be carefully observed. Every observing and unprejudiced surgeon will admit that, since the adoption of the new process, there has been a remarkable reduction in the rate of mortality following major amputations. When we consider that formerly one-third of all cases were absolutely lost through primary septicæmia or pyæmia, or indirectly to secondary hemorrhage due to ulceration, we may well hesitate before we condemn, or even slight, a process that practically prevents death from blood-poisoning or secondary hemorrhage, when the operation has been performed under strict antiseptic conditions. Under favorable conditions, and in cases that were not moribund or hopeless, the death-rate does not exceed five per cent by a most careful estimate. In amputations, every stage of the operation must be covered by aseptic precautions. In mildly septic cases, characterized by suppuration, the field of operation should be prepared in the general manner already indicated in a former article. After the patient has been anæsthetized, and Esmarch's constrictor applied, the whole surface of the limb, excepting the field of operation, is wrapped in clean towels, the hands of the operators are finally disinfected, the irrigator is started, and the operation commenced. By the exercise of a moderate amount of care in the management of details, it is not very difficult in such cases to prevent suppuration, and secure primary union.

But when the amputation has to be done through ulcerating or suppurating portions of the limb, the surgeon is confronted with a more difficult problem. The precautions taken are more radical, and the skin surrounding the sinus or ulcer must be treated with soap and water, applied with the friction of the brush: the ulcer or sinus must be thoroughly washed with an eight per cent solution of chloride of zinc, and the granulations scraped off with a sharp-edged spoon. In septic cases of still greater intensity, the difficulties encountered are more formidable, and the traumatic lesion must be guarded by the strongest antiseptic; an irrigation, 1 : 500, to 1 : 1,000, of bichloride being justified.

In dealing with such filthy masses, the hands coming in contact with the infected tissues must be repeatedly washed in freshly prepared lotions, and every article that has come in contact with the focus of infection must be rejected.

Amputation wounds of this description require "open treatment," with loose packing and moist dressing, but no sutures.

In laparotomy, the aseptic method affords a most interesting field of observation to the operator. This department of surgery has been the most unsatisfactory, and perhaps the least scientific, of all the wide range of surgical interference. Indeed, many authorities have gone so far as to term ovariotomy as simple butchery, and not worthy to be dignified as surgery. When we consider the results attending this operation, the risks of diagnosis, the extended complications, and the dangers resulting from the exposure of large portions of the abdominal viscera, can we wonder at the unwillingness of many surgeons to interfere with these abnormal growths? Is it not strange that the results have been so discouraging? It is more surprising that so many victims have survived an ordeal so severe and uncertain.

Although the aseptic method has materially reduced the dangers of *exploratory* laparotomy, yet the greatest caution and the wisest conservatism should be observed in attempting operations of this character.

For no surgeon is absolutely sure of his ground. He must work to some extent in the dark. He may be thwarted in his attempts to prevent accidental wound infection. He may encounter the dangers incidental to anæsthesia, and may be surprised by those insidious conditions so often found when least expected, — nephritis, thrombosis, and embolism. Exploratory incision is only justified when, in a disorder threatening life, all other means of diagnosis have failed, or when ocular inspection or digital examination can alone estimate the extent and relations of mechanical disturbances. In such cases, due observance of the rules against infection will, with great certainty, exclude suppurative peritonitis.

In the operation for the removal of abdominal tumors, the usual preparation of hands, sponges, instruments, and other utensils, makes it unnecessary to apply disinfectant lotions to the abdominal cavity, where, by their corrosive properties, mischief may result. Care should be taken against unnecessary exposure of the body, for excessive loss of heat is a great factor in determining collapse. And this principle of exposure applies equally to the contents of the abdominal cavity; and the greater the incision, the more attention must be given to the protection of the intestines. Hot, flat sponges or warm towels should hide from view every thing except the spot to be operated upon. Special care should be taken against undue cooling off of the peritonæum, on account of the collapse that may follow. Authorities differ as to the use of the spray during the operation. Some consider it essential, while others declare it to be "harmless but unnecessary." The use of spray in general is really an objectionable feature of the original Listerian method, and is abandoned by most operators. De Gerster declares that he has not used the spray apparatus since 1881. In the removal of an abdominal tumor, an ample incision is an important condition, in order that the whole of the diseased mass may be easily manipulated, especially in the complication of adhesions. Of course, *unnecessarily* long incisions should be avoided, because the exposure of a large peritoneal surface to the atmospheric air is attended with risk; but this precaution has given rise to the habit of making the incision too small. The surgeon's discretion will guide him in this direction, and a practised eye is better than any technical rule of the books. The relations of the bladder to the tumor should not be overlooked. Greig Smith objects to emptying the bladder before operation, because a *full bladder* is not in much danger of receiving injury; and injury to an empty bladder has not unfrequently occurred in the presence of abnormal adhesions. The intervention of a solid male urethral sound is useful in ascertaining the extent of the adhesions of the bladder.

After the removal of the tumor, and the thorough antiseptic washings and cleansings have been carefully attended to, the abdominal wound should be closed as rapidly as is consistent with thoroughness in the management of the *suture*. This should combine the elements of simplicity and solidity; a Peaslee's needle being used in bringing together the abdominal walls, including the perinæum, the points of entrance and emergence being at least two inches from the edges of the wound. Gerster directs that a piece of disinfected silver wire, or stout silkworm gut, threaded through the eye of the needle, be used, armed with a quill, or a leaden plate or shot. This is then withdrawn, bringing out the end of the thread from one side of the wound to the other, where it is temporarily secured by an artery forceps. These retentive sutures are used at intervals of about an inch, until the entire length of the incision is covered by them. These are some of the details of an antiseptic method, which, in the hands of several eminent specialists, has shown admirable results, giving to this phase of laparotomy the dignity of a surgical operation. The guarding process cannot be too rigidly enforced, for oftentimes an insidious septicæmia will vex and surprise the operator, which can be traced to the careless use of sponges by inexpert hands, or by having too much interference by superfluous attendants. There is no disguising the ugly fact that many rapidly fatal cases, which have been attributed to the convenient but vague cause of "shock," or "exhaustion," were found upon closer inquiry to be cases of acute septicæmia.

And so through all operative surgery, the new method commends itself as reasonable from a scientific basis, clean and safe in its practical process, humane in the desire to save life, and in the line of that evolution which is opening the eyes of the conservative surgeon, and unfolding new sources of power in every department of scientific investigation.

[Original in *Popular Science News.*]

SUCCESSFUL MODERN DENTISTRY.

BY M. J. GASTON.

Oculists, aurists, chiropodists, dentists, and other specialists abound, and they are very useful folk, and are each in his way as necessary to repair or adjust the various impaired organs of the human body when injured by disease or age as is the general practitioner in legitimate medicine.

No one of the professions mentioned is more lucrative or more useful than the dentist, — he who cares for the primal organs of digestion, to fit them for service if diseased, or, if decay destroy the originals, to furnish substitutes so superior that art supplies the lack of the natural organs.

Classes of graduates leave their *Alma Mater* year after year, and enter the profession, who become prosperous and wealthy citizens through the practice of this specialty, and who have given their lives to the study of the tooth, and the application and manufacture of artificial teeth when the originals

are gone, to the great improvement of their patients' health and of their personal appearance and full enjoyment of life.

The original method, that of tying the end bough of a strong hickory or oak sapling to an aching and decaying tooth, to the necessary physical, and let us hope moral, elevation of the afflicted patient, is now so much improved upon that an elegant upholstered chair and a breath of laughing-gas makes pain a pleasure.

The tooth may be said to be an enlarged papilla of the mouth which has undergone such evolutional and chemical changes that it has acquired a remarkable degree of hardness.

The fully developed tooth consists of three parts, — the crown, the neck, the root. In the centre of the tooth is a canal, which is filled with what is known as dental pulp. This consists of connective tissue, nucleated cells, blood-vessels, and nerves. Each cell sends one process or more into the tubules of the dentine, while other attractions or repulsions unite with other cells in the membrane and in the interior of the mass.

"Upon the outer surface of the dentine of the crown of the tooth is the enamel, the hardest substance of the body. It is composed of closely crowded polyhedral prisms, the enamel prisms,

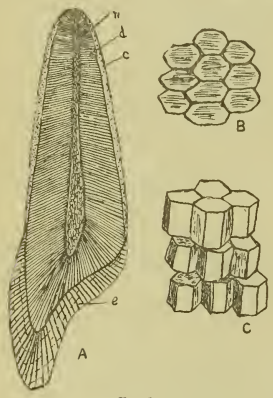


FIG. 1.

A, Longitudinal section of a tooth; *e*, enamel; c, cementum; *d*, dentine; *n*, nerve, or pulp. B, Enamel rods or prisms. C, Enamel prisms showing arrangement in layers. B and C, Magnified 450 diameters.

enamel columns, enamel rods." Here, as in many other instances of scientific inquiry, one is met by the question of connection. The particles are in close connection, but what attraction causes them to rush into combination? What invisible force ranges the particles into rank and file, hollow squares, and triangles? And why, in the dentine pulp, will whole brigades of particles change position and form anew?

Enamel is one of the most indestructible of substances arranged in the same polyhedral figures; and the attraction which cements these prisms together is a substance, force, or law, as unknown to investigators as are the laws of crystallization.

There are constant improvements in manners and methods of building up the old teeth, and fashioning the artificial sets. One of the latest of these improvements is given to the public by a paper read by Dr. Abbott before the New York Academy of Medicine, and printed in the *Medical Record*.

Artificial sockets may be excavated in the jawbone, and teeth that have long before been extracted may be inserted, and, being for a time fastened firmly into place, become in time thoroughly united with the tissues of the socket, and thus become serviceable members, as firmly fixed as others that have never been displaced.

This is now spoken of as a new wonder; but there is on record an account of a like operation, published in the work of Abbé Paré in 1561.

"I have heard of an operation represented by a credible person that he saw a lady of the prime nobility, who, instead of a rotten tooth which she drew, made a sound tooth, which was drawn from one of her waiting-maids at the same time, to be

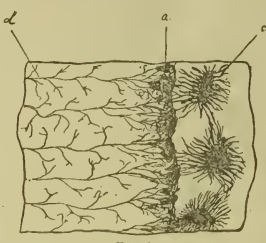


FIG. 2.

Section through cementum and dentine. *c*, Lacunæ or cells of cementum. *d*, Dentinal fibres. *a*, Network of fibres connecting with lacunæ.

substituted and inserted; which tooth, as it were, took root, and in time grew so firm as that she could chaw upon it as well as upon any of the rest."

One great authority upon this topic inserted a tooth into the comb of a cock which fully grew to the comb.

It is recommended to replant the tooth if knocked out by accident, or extracted by mistake. And one of the most successful of operations is the re-inserting of teeth that have been extracted to favor difficult surgical operations, as in abscesses.

But it is only in the last three or four years that Dr. Younger attempted for the first time to insert foreign teeth — teeth other than those of the subjects — into artificial sockets in the jaw-bone, and often with great success. He has performed the same feat forty times or more with success.

As no person who has undergone this method has had the tooth extracted to allow investigation of the process by which nature does her work, the process is unknown. But it is believed that a union takes place between the membrane covering the root of the tooth and the tissues of the bone.

A *post-mortem* would throw light upon this subject.

A person was present at the session of the Medical Society before whom Dr. Abbott read his paper, who had had two teeth implanted six months before, and which were seen to be firmly fastened, although they had been extracted from the jaws of their original owners eight years before.

There has been no means discovered by which the artificial plate may be discarded where the full set of teeth are artificial; but science has accomplished so much, that means may be found to obviate this difficulty.

IOWA CITY, IOWA, *Aug.* 1.

[Original in *Popular Science News.*]

KUHNIA AS A MEDICINE.

BY DR. S. F. LANDREY.

A VERY common plant in the Central and Western States commonly known as hog-weed, or fallow-weed, and named by the Miami Indians "Pony-tail," is that known to botanists as *Kuhnia eupatorioides*, a composite plant of medicinal value. It is called hog-weed because common, and appropriating more than its share of ground in a field; fallow-weed, for it yields to the plough, disappears by cultivating the ground, and seems to thrive best in fallow-ground and neglected places. No reliable information can be gleaned concerning it in the dispensatories and usual medical sources. These do not so much as mention its name. Even *Paine's Concentrated Remedies*, that gives the properties (irregularly) of over eight hundred plants, mentions *Kuhnia glutinosa*, and then refers to four species of *Eupatorium!* proving that the author did not understand kuhnia. Its discovered value, then, can be conscientiously claimed by the author of this article, — one, at least, of the best remedies in the *materia medica*.

It is a well-known fact, that most tonics are bitter; stimulants pungent and warm-tasting; astringents "drawing;" narcotics bitter, acrid, or unpleasant. Taste and odor thus become moderately safe guides to an experienced judgment in pronouncing on the qualities of a new plant without the safer and more accurate methods of chemistry, which are not always available when in the forest or field, and away from the laboratory. Poisonous plants, too, are generally well known: those that are non-poisonous, not inimical to health and life, are the only safe ones to be tested by odor and taste. Having had a botanical knowledge of kuhnia, and its Order, Compositæ, I did not hesitate to taste and examine it critically, with a view to its utility as a medicine. This was some years since, on coming out of a house where lay several children severely afflicted with dysentery. The horrible *tormina* and tenesmus demanded that something be done at once for their relief. Opiates and astringents seemed but to aggravate their distresses. I knew the plant was excellent in diarrhœa, why not in acute dysentery? An infusion made by pouring boiling water on the leaves, — an ounce or more of leaves to the pint of water, covering till nearly cool, — was given freely — almost without regard to quantity. The effects were magical. The pains ceased: no blood nor mucus were any longer observed in the dejections. Speedy recoveries were the rule. The medicine being cheap and common, the poor could pay a reasonable bill. It warmed the stomach, produced a determination of blood to the surface, promoted sweating, and thus relieved the over-gorged colon and small intestines. It seemed also to act as a local anæsthetic to the painful inflamed mucous surfaces of these organs. As a diffusible stimulant, the patient's muscles were strengthened — no combination of tonics and stimulants could have acted more promptly. In twelve to twenty-four hours convalescence began. During the prevalence of the endemic dysentery in Kokomo in 1862 was the best test of its efficacy.

One family had lost two of their children. The father prevailed on me to leave my own town, and stay at his house, while the disease lasted in his family. No others died, — a family of six still living at the close of the endemic. Nor did they any longer fear its ravages. My services were no longer needed; for they had learned to use, successfully, the remedy. It has been found equally good in cases of atonic dyspepsia, general debility, colic, gastrodynia, and intermittent-fever. The poor man's panacea, — it calms a fever equal to quinine, and acts as an antiperiodic; cures a colic as quickly as allspice, ginger, and dioscorein; a stimulant equally as good, and not so unpleasantly warm, as cayenne pepper; a nervous exhilarant little below the best of wine, without its intoxicating qualities; almost a specific in recent colds, catarrh, bronchitis, and croup. Its proper sphere of usefulness, however, is in toning the gastric follicles, and giving tonicity to the muscular coat of the stomach and intestines. Taken cold, the infusion is a tonic; warm, it is a diaphoretic and

diffusible stimulant, in doses of an ounce or two. Boiling dissipates some of its strength. Even the tincture differs in its action from the infusion. But the leaves, dried or green, are uniform in action if properly prepared. Like Withering's infusion of digitalis, which Dr. Meigs preferred to any other preparation; so the infusion of kuhnia is the preferred method of using it, and the best form of administration. Native remedies are too much ignored, and costly foreign products are too often substituted. America has a *materia medica* of her own, unequalled by any other continent. Willing hands to gather her products; able chemists to extract the medicinal virtues; and careful, intelligent, experienced physicians to properly administer these remedies, — are all she needs to ameliorate the sufferings of a misguided humanity.

[Specially compiled for the *Popular Science News*.]

MONTHLY SUMMARY OF MEDICAL PROGRESS.

BY W. S. WELLS, M.D.

Dr. Abril communicates to the *London Medical Record* a rapid and simple method of reducing dislocation of the shoulder. In the methods ordinarily employed for the reduction of dislocations downward of the humerus, the trunk is fixed, and the head of the humerus is raised into the glenoid cavity. Dr. Abril inverts this procedure. His plan is to fix the humerus, and to make the glenoid cavity descend on the head of the displaced bone. He makes the patient stand with a crutch in his axilla; he then holds the hand of the affected limb, making slight traction downward; the patient is now to let himself down as if he were going to fall on his knees, and as he falls, the head of the humerus glides into its normal place. Dr. Abril claims for his method that it is most simple, easily and quickly done, that chloroform is not necessary to obtain muscular relaxation, that the pain is trifling, and that no assistants are required.

The *British Medical Journal*, July 14, calls attention to the treatment of wounds by continued irrigation, and describes a permanent apparatus now in use in the London Hospital. This comprises a large tank supplied by hot and cold water-pipes; a window in its side shows the level of the water, and exposes a thermometer, by which the temperature of the water is adjusted. From the tank, irrigating-pipes pass to different beds, and the water is drained off by a pipe leading to the basement. Irrigating-tubes are passed through the wound to be treated, and the passage of the water through the tubes is kept up as long as may be necessary. A case is mentioned in which a stream of water has been running over a crushed elbow, day and night without intermission, for nearly three months. In the same *Journal* of July 7, Mr. Treves describes this method, and reports a case in which a stream of water ran through a patient's knee-joint, without a moment's cessation, for a period of thirty days. Cold water was employed, to which was added a minute quantity of corrosive sublimate, carbolic acid, or boracic acid. Mr. Treves found the effect of this plan of treatment very pronounced. It relieved pain, reduced temperature and swelling, and promoted the cure.

The *London Lancet* reports a case, described by Dr. Desvernine, of repeated hemorrhage from the mouth, occurring in an otherwise healthy man, aged fifty-three, the cause of which for some time was obscure.

On making a laryngoscopic examination, an ovoid tumor, measuring two centimeters by one, was found attached by a peduncle to the laryngeal aspect of the epiglottis. The tumor appeared to be lobulated, and was of a violet color. From the hemorrhages, the color, and general appearance of the tumor, Dr. Desvernine diagnosed it as an angioma, and decided to remove it by means of the galvano-cautery, which was accomplished without difficulty, the pharynx and larynx having been previously anæsthetized by means of a strong solution of cocaine. Examination of the tumor showed it to be a pedunculated and encapsuled angioma, or tumor consisting chiefly of newly formed blood-vessels.

At the last meeting of the American Medical Association, Dr. Henry J. Reynolds of Chicago read to the section on dermatology and syphilography, a paper on the galvanic method of treating the vegetable parasitic diseases of the scalp. He said the reason that all heretofore adopted methods for treating these diseases had been ineffectual was because the parasiticide applications employed to destroy the fungus could not be so applied as to penetrate the hair-follicles and into the hair structure itself, — the parts invaded by the disease.

The great object to be attained, therefore, must be the penetration of the remedy employed to the heretofore inaccessible parts. He employs the galvanic current for this purpose.

After first washing well with soap and water, he applies a one-per-cent solution of bichloride of mercury, or other parasiticide lotion, with the sponge of a positive electrode of a McIntosh battery, to the affected part for about ten minutes once a day, the circuit being completed by placing the negative on some adjacent point, and the current should be as strong as the patient can bear.

This plan is indorsed by Drs. Charon and Gevaert of the Hospital de St. Pierre, Brussels.

Dr. Edward Lang of Vienna (*Wiener Med. Blätter*) reports four cases in which cancer and the lesions of syphilis coexisted in the same individual. He believes that cancer was developed upon a syphilitic foundation, and that the latter is therefore to be regarded as one of the possible, though very rare, exciting causes of carcinoma.

The *Medical Times* regards a solution of chromic acid, from two to five grains to the ounce, as perhaps the best application to mucous patches, especially to those in the mouth and the pharynx.

Dr. Hoffmann of Baden-Baden (*Medical News*) suggests, regarding the treatment of enlarged tonsils, that, instead of cutting off portions by the knife or tonsillotome, a blunt hook should be passed into the apertures on the surface of the gland, and made to tear its way out, or blunt-pointed scissors may be used instead.

The result of this treatment is to evacuate any retained secretion or curdy pus, and afterwards to secure diminution in size of the gland, by cicatricial contraction of the tears or cuts. Dr. Hoffmann prefers the blunt hook to the scissors.

The principle of this practice is based on the view, that there shall not be allowed to remain, either in the tonsils, or posterior thereto, any opening which has not been explored to its base, and then laid open, and converted into a cleft, which, during every act of swallowing, opens, and thereby empties itself, so that no inflammatory products can attach themselves.

The Paris correspondent to *Philadelphia Medical Times* writes that intestinal antisepsis in typhoid-fever cases is receiving marked attention. In the treatment of such cases, Professor Bouchard first introduced naphthol; and Dr. Legroux is at present applying it in his service at the Children's Hospital with great success. As soon as a child is brought in, suffering with symptoms of typhoid, the intestines are at once cleared out with calomel, given in doses of .30 to .60 centigrams, depending on the child's age. The next day the intestinal antiseptic treatment is commenced as follows: ℞. — Naphthol beta, bismuth salicylate, āā 2.50 grams. M. Divide into ten powders, and give one every hour in a wafer, or mixed with a little milk or brandy. If the diarrhœa is not important, the bismuth may be left out, and only the naphthol given; and if, on the contrary, there is constipation, then give the following: ℞. — Naphthol beta, 2.50 grams; magnesia salicylate, 2.50 to 5 grams. M. Divide in ten powders, and give one every hour until the bowels are free, and then continue with naphthol only, as before. There will be found a diminution or entire suppression of intestinal meteorism, and that the stools are disinfected, no longer giving the fetid smell of typhoid. The mouth and tongue will clear up, the general condition will improve, and the disease will run a short course.

With the view of preventing ammoniacal changes in the urine in chronic cystitis, Dr. James Little (*Dublin Journal Medical Science*), in several recent cases, has used saccharin, giving about six of the tabloids daily. In all these cases, when the urine was passed, or the residual portion drawn off, it was free from ammoniacal odor.

The *Medical Record* states that the sticking-plaster treatment of erysipelas is highly recommended by Professor Wölfler of Gratz. Strips of isinglass plaster, about the breadth of the thumb, are applied over the affected surface.

THE SIGHTSEER'S HEADACHE.

Of the lighter penalties which pleasure entails, none probably is more widely known and felt, or more persistently endured, than the sightseer's headache. It is nature's tax levied on the comfort of that great body of busy idlers to which we all at some time or other belong. It is endemic among the frequenters of museums, picture-galleries, and exhibitions, varying somewhat, perhaps, in different cases in its precise causation, but associated always, in a manner significant of its origin, with the habits of the observant loiterer. The circumstances in which it arises afford the most reliable clew to its true character. Among these, temperature, atmosphere, and strain, both of body and mind, though commonly combined, play their several parts in varying degrees of activity. The influence of a warm and close atmosphere as a cause of headache is too well known to require more than a passing notice. The torpid congestion of tissue which it tends to induce, and from which the brain is not exempted, is familiar to most of us as a morbid process too often illustrated in our painful experience. It contributes its proportion, doubtless, towards that total of *malaise* which affects the visitor to a crowded picture-gallery or assembly-room, and culminates in the localized ache which renders the slightest mental effort a weariness. The very general prevalence of this variety of headache, however, and its independence in many instances of any vitiation of atmosphere, teach us to look for its explanation in other causes. The effort of mind implied in long-continued observation, even though this does not involve the strain of study, has probably an appreciable though a secondary influence. Fatigue certainly has an important share in its production; but it is with most persons rather fatigue of muscle than of brain. The maintenance of the upright posture

during several hours of languid locomotion; the varied and frequent movements of the head, commonly in an upward direction; and the similar and equal restlessness of eyes, whose focus of vision shifts at every turn, as a new object presents itself, — form a combined series of forces more powerful in this respect than the sunlight and frequent changes of mental interest and attention by which they are accompanied. The muscular strain implied in these movements is necessarily very considerable: it affects, more or less, every member of the body. But the distant localization of the resulting ache has probably much to do with the unusual activity of the cervical extensor and rotator muscles, and of the muscles which move the eyeball. Whatever the minor influences at work, therefore, there can be little doubt that mere fatigue is primarily accountable for this most general form of headache, and that rest and nourishment are most reliable antidotes. The utility of stimulants for this purpose is necessarily temporary and deceptive. One improvement on existing arrangements ought to be of real assistance to the suffering sightseer, if more generally introduced by responsible authorities. The comparative scarcity of seats in many places of amusement has often been noticed. It would be much to the public advantage if this want were supplied. For the attendants at exhibition stalls, a chair for occasional use is an absolute necessity. — *Lancet.*

SOME ANSWERS IN PHYSIOLOGY.

As an additional contribution to answers, we give the following, taken by the writer from the note-books of pupils of one of the *high-schools* of this country: —

"Anatomy is dissecting of bodies generally lifeless." "Anatomy is study of parts of the body, physiology study of action of parts, hygiene is *application* of these parts" (Italics are ours). "Kinds of bathing, adapted to the age, quantity, quality, and health of the person." "Supernator are the muscles about the back." "The hygiene of a muscle should have proper rest and exercise." "Hygiene is the study of the time and manner of the action of the muscles and large blood-vessels." "The mouth is the commencement of the alimentary canal, and it extends through the throat, œsophagus into the stomach." "The extent of the mouth helps the digestion of food." "Nervous system a decided part of the body." "A young person who goes to parties and has great excitement has generally some brain trouble, such as St. Vitus dance." "It is far more reliable to drive out the fire of a room and put on extra clothing than it is to put on no clothing and sit in front of a burning fire." "Soap is important in carrying off the fat of the body." "What is eaten by the body has sometimes been taken as food." "The third cavity is the pelvis, which contains the vital organs." "In a diet of twenty-four hours a man should eat some of all the nutritious articles." — *From "Teaching Physiology in the Public Schools," in the* POPULAR SCIENCE MONTHLY *for August.*

MEDICAL MEMORANDA.

TAKING THE THERMOMETER, AND LOSING THE TEMPERATURE. — An Italian patient in one of Dr. Shrady's wards in St. Francis Hospital, deliberately chewed a fever-thermometer, and swallowed the greater part of it before he was made to understand that the instrument was not intended as a medicine. Luckily, he has had no subsequent increase of temperature, which would make it necessary to risk another thermometer in that way. The rectum will be the next choice.

PHOTOGRAPHS OF THE EYE. — Dr. Claude du Bois-Reymond and Professor Cohn have obtained photographs of the eye by means of the lightning illumination. The illumination is so sudden and fleeting, that when it occurs in a chamber in previous absolute darkness, the pupil has not time to contract, and thus the maximal dilatation can be represented on photographs. It is hoped that by appropriate arrangements the retina can thus be photographed during life.

DETECTION OF TYPHOID BACILLI. — Dr. Victor C. Vaughan, director of the laboratory of hygiene at the University of Michigan, thus describes how he detected the germs of typhoid-fever in the air taken from the sewer: "A quart bottle was filled with boiling water. This destroyed any germs that might be present in the bottle. After cooling, the bottle was held in the sewer with one hand; the space about the arm being closed, in order to prevent the gas coming up into the face. With the thumb and finger the cork was removed from the bottle. Of course the water passed out, and the sewer-gas passed in. The stopper was replaced while the bottle was still in the sewer. Some days later a half-ounce of sterilized water was poured into the bottle, shaken, and cultures made with this showed the presence of the typhoid bacillus."

AN AUTOMATIC APOTHECARY. — An American manufacturer of sugar-coated pills added to the attractions of an exhibit of his product in London an ingenious piece of mechanism, which might have been intended to represent the pharmacist of the future. It was in the form of a cabinet, provided with a series of knobs or buttons, each inscribed with the name of some malady for which a remedy might be asked. The customer puts a coin into a slit, and presses the button calling for the remedy he requires, when immediately a drawer flies out containing the article sought. This automatic dispenser, of course, makes no mistakes. If the customer accidentally presses the wrong button, he alone is responsible for the error.

HUMORS.

AN AMBIGUOUS COMPLIMENT. — "If you use my mixture once," said a patent-medicine man, "I'm sure you will never use any other." — "No," was the reply, "I don't suppose I ever would."

A REMARKABLE OPERATION. — *Reporter* (to eminent physician): "Any thing new this morning, doctor?"

Eminent Physician: "Oh — um — ah, yes: an operation at the Cheek and Chin Hospital, one of the most wonderful known to science. I took out a man's pericardium, put three stitches in it, and restored it. The patient lived twenty minutes. A most rare and successful case."

HOW TO BE HEALTHY. — All that one has to do to maintain perfect health is to carry a buckeye and a potato in the pocket; wear a lung, pad a couple of porous plasters, and a magnetic belt; go to bed at nine o'clock every night, and get up at six in the morning, taking a cold-water bath, and walking seven miles every day before breakfast; abstain from the use of tobacco, tea, coffee, all manner of intoxicants, and rich food of every description. By obeying the above simple rules, your life may be made one continual round of giddy health. — *Texas Siftings.*

HE COULDN'T AFFORD IT. — A mother was urging her son to purchase an overcoat, and he was insisting that he could not afford one.

"Very well, then," said she, "you will get pneumonia, see if you don't."

"No," said he, "I won't get that either; I can't afford any thing new." — *New-York Sun.*

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SETH C. BASSETT,
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SPECIAL NOTICE.

The Publishers of the NEWS *earnestly request that subscribers will make their remittances either by draft on Boston or New York, or by a postal order. If it is absolutely necessary to mail money, it should be sent* ONLY IN A REGISTERED LETTER. *The publishers decline to assume the risk of money mailed in unregistered letters.*

Remittances will be duly credited on the printed address label of the paper; but if they are received after the 15th of the month, the change in the label cannot be made until a month later. If a formal receipt is desired, a two-cent stamp or a postal card should be enclosed with the remittance.

Publishers' Column.

SAVE us from the critics, but bless the pen, especially if Esterbrook is stamped upon it. The stationers furnish them.

DR. W. C. CAVENAGH, Memphis, Tenn., writes: "For weak digestion, general debility, and want of appetite, I cheerfully recommend 'COLDEN'S LIQUID BEEF TONIC.'"

IN 1879 a BOYLE ICE MACHINE was erected at Atlanta, on a new plan, making ice from distilled water; and so carefully was it designed, that it proved a most perfect success, and has been the model after which all the Boyle ice machines have been built since then.

ALTHOUGH it has only been in the market for a short time, the number of SAWYER HOT WATER AND STEAM HEATERS in use is very large, and constantly increasing. It is a most excellent apparatus, and worthy of the attention of those intending to introduce a heating system into their buildings.

THE success attained by the U. S. Gutta Percha Paint Company of Providence, R.I., in the introduction of their manufactures, is due to the fact that they have from the first held firmly to the plan of supplying first-class goods at reasonable prices. In addition to their U. S. Gutta Percha Paint and "H. P." Restorative Oil, both of which they manufacture and control, they have other valuable specialties in paints which our readers will do well to inform themselves about.

DR. H. P. ATHERTON, Great Barrington, Mass., says, "I have been using and prescribing your Acid Phosphate for a number of years. The results have been so satisfactory as to justify me in giving it my unqualified indorsement. I have found it a refreshing and exhilarating beverage during summer months. In a case of reformed inebriety, I have observed its restorative effect in toning up the system, and correcting the nervous derangement, of the subject."

IT is a growing conviction, notwithstanding the large number of fountain pens, stylographs, and similar writing devices, the majority of which are but vanity and vexation of spirit, that nothing has yet supplanted the old-fashioned lead pencil in efficiency and reliability. The efficiency of the lead pencil, however, depends very much upon the care bestowed in its manufacture, the quality of the materials used, and the attention given to the proper grading of the leads. It is our pleasure to say that Dixon's "American Graphite" pencils, made by the Joseph Dixon Crucible Co., Jersey City, N.J., fill all the requirements of a perfect pencil. The workmanship is unexcelled throughout: the wood is soft and easily cut; the leads are tough, and smooth, and free from grit; and the ten degrees of hardness in which they are made permits the selecting of a pencil just suited to the work required of it.

The Popular Science News

AND

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CONTENTS.

FAMILIAR SCIENCE.—J. H. Debray 145
Notes for Amateur Photographers 145
The Royal Botanical Gardens at Kew 146
The Tendency of Matter at the Surface of the Earth 147
Paris Letter 147
Scientific Brevities 148

PRACTICAL CHEMISTRY AND THE ARTS.—Nickel and Cobalt: the Twin Metals 149
Kerkook Petroleum Springs, Asia Minor 149
Windmills for Electric Lighting 149
Association of Hydrocarbons with Rock-Salt in Nature 149
A Useful Table 150
The Aniline Industry in Germany 150
Railroad Notes 150
Industrial Memoranda 150

HOME, FARM, AND GARDEN.—Orchids 151
The Oak-Pruner 151
Toilet Recipes of Ancient Egypt 152
The Rapid Defoliation of Trees 152
Gleanings 152

EDITORIAL.—The Cleveland Meeting of the American Association 153
Meteorology for August, 1888, with Review of the Summer, 154
Astronomical Phenomena for October, 1888 155
Questions and Answers 155
Literary Notes 155

MEDICINE AND PHARMACY.—The Amenities of the Doctor's Life 156
Otitis 156
Monthly Summary of Medical Progress 157
The Diagnosis of Human Blood 157
Medical Memoranda 158
Humors 158
PUBLISHERS' COLUMN 158

Familiar Science.

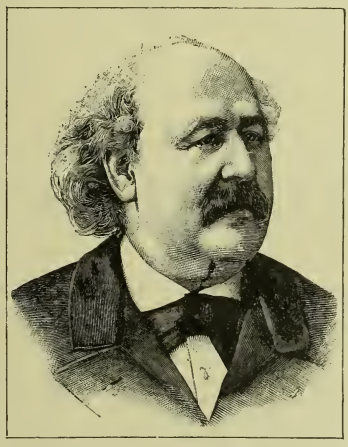
J. H. DEBRAY.

WE give below a portrait of the distinguished French chemist J. H. Debray, who died at Paris on the tenth day of last July, at the age of sixty-one years.

The name of Debray is almost constantly associated with that of Deville, who was at first his instructor in chemistry, but who soon became his co-worker, — a connection which was kept up for many years, until the retirement of Deville from active work.

Debray made numerous investigations upon glucinium, molybdenum, tungsten, and allied elements, in the line of synthetic mineralogy; but it may be said that his two principal works were his studies of the platinum group of metals and his researches upon the dissociation of chemical compounds. In connection with his friend Deville, he made a most exhaustive study of the properties of platinum and the metals chemically allied to it. The investigations extended over a term of twenty years, and added much to our knowledge of these peculiar elements, besides having great practical value in determining the best metallurgical methods for smelting and working these useful and valuable metals.

In taking up the study of the laws of dissociation, he entered a field already opened by Deville. He showed, that, when many chemical compounds are submitted to the action of heat in closed vessels, they are decomposed into their constituents, and that this decomposition is dependent upon temperature and pressure, and is governed by exact laws. He found, for example, that when carbonate of lime is heated in a closed vessel, at a low red heat it is decomposed, and carbonic dioxide is given off, but that at a temperature of about 1580° F. the decomposition ceases as soon as the disengaged carbonic deposit acquires a tension of 85 millimeters ($3\frac{1}{2}$ inches). If the temperature is increased to 1904° F. the decomposition is not arrested until the tension of the confined gas equals 520 millimeters (20 inches). These phenomena are analogous to those of the solution of solids and the vaporization of liquids, and not only are of the highest importance from a chemical point



of view, but indicate the connection between chemical and physical laws.

Debray was a member of the faculty of the Normal School at Paris, and in charge of its laboratory. Under his care and that of his predecessor, Deville, many celebrated chemists have received their education in this laboratory, and much valuable work has been accomplished, among which may be mentioned the isolation of the element fluorine by Moissan. He was in every way a most eminent and distinguished chemist, and his loss will be severely felt in scientific circles.

NOTES FOR AMATEUR PHOTOGRAPHERS.

THE advantage of keeping the developing fluid on a plate in constant motion is indisputable. The development proceeds more evenly, air-bubbles are removed, and spots and streaks are to a large extent prevented. We illustrate a simple mechanical arrangement (Fig. 1) on the principle of the pendulum, which can be made by any amateur, and will be found very convenient. The supporting framework is made of stout wire covered with rubber tubing.

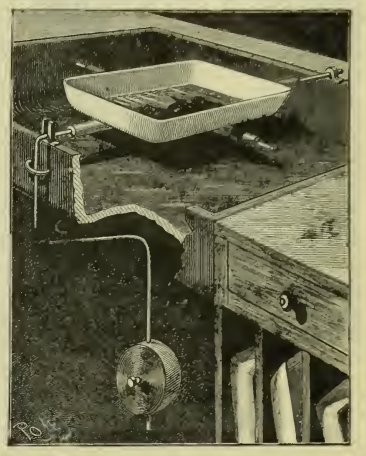


FIG. 1.

Glass rods might be substituted if one has a little skill in glass-blowing. It is only necessary to fill the tray with the developing fluid, immerse the plate, and set the apparatus in

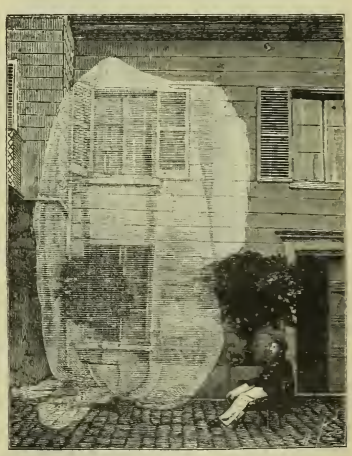


FIG. 2.

motion, which will continue for a period long enough for the development of the most refractory plate.

The "photographic spectre" (Fig. 2) is an amusing application of the process, sadly

familiar to most amateurs, of taking two pictures on the same plate. The illustration shows a person confronted by a gigantic phantom; and the effect was produced as

Fig. 3.

follows: The person sitting in the chair was first focussed upon the ground glass of the camera, and the place where the instrument stood, marked upon the ground. It was then moved towards a person covered with white

Fig. 4.

cloth, representing the ghost, until his image was of a sufficient magnitude, and the position of the camera again marked. The camera was then returned to its first position, and the first sitter photographed in the usual way. The person representing the spectre then took his place, the instrument was moved to its second position, and a very short exposure given; this was sufficient to impress the second image on the plate without obliterating the details underneath it, thus giving the effect of transparency to the supposed spiritual visitor. The development and subsequent treatment of the plate was carried out in the usual manner.

The "photo-bust," or statuary effect, is very easily accomplished. Fig. 3 shows the result obtained by the method, and Fig. 4 the arrangement of the model. A piece of wood painted to represent a pedestal is placed in position, and the subject stands behind it, posed so that only the head and bust are visible. A more realistic effect is obtained by powdering the face and hair. A perfectly black background is used; and after the picture is developed, the arms or any parts of the figure not intended to be shown are scraped off the plate with a knife. The glass is thus rendered transparent, and in the finished photograph the portrait bust stands out against a black background like a marble statue.

We are indebted to *La Nature* for the above engravings.

[Original in *Popular Science News.*]

THE ROYAL BOTANICAL GARDENS AT KEW.

BY K. B. CLAYPOLE.

Botanical gardens on a wet day are not attractive to the general visitor, and even the student of botany or horticulture would do well to wait for sunshine, if he would to the full enjoy their beauties. If, however, limited time compels him to take the day apportioned for his visit to the Royal Botanic Gardens at Kew, be it wet or fine, he will be amply repaid for his courage, even if he should get no farther than the museums of economic botany.

These museums, three in number, owe their origin to the first director of the Gardens, Sir W. J. Hooker, who took advantage of the addition of a building to the Gardens in 1847 to ask permission to have one room in it fitted up with cases for the exhibition of vegetable products, — objects which neither the living plants of the Garden nor the preserved specimens of the Herbarium could show. This request being liberally met, the director presented his private collection as a nucleus, and the museum was forthwith commenced. No sooner was the establishment and aim of the museum generally made known, than contributions poured in from all quarters of the globe, until, in a few years, the ten rooms of the building, with its passages and corners, were absolutely crammed with specimens. Application was then made to Parliament for a grant to defray the expense of an additional building for the proper accommodation of the objects; and, as the result, the house occupied by Museum No. I. was opened to the public in the spring of 1857.

In dividing the extensive arranged collections between the two museum buildings, advantage was taken of the two grand classes under which the orders of flowering plants are found to be grouped in nature; No. I. being devoted to the dicotyledons and gymnosperms, and No. II. to monocotyledons, together with all the products, etc., yielded by those plants, which are commonly regarded as not bearing flowers, as mosses, ferns, seaweeds, lichens, and fungi.

It is, of course, impossible in a short time to give great attention to all the orders represented in the cases; though, as we pass from one to another, we learn the sources of many articles of food, medicine, or use in the arts, or even of mere curiosity, and we become impressed with the great number of the products furnished by the vegetable kingdom for our use and convenience. In the cashew-nut order (*Anacardiaceæ*), for instance, we find a series of specimens illustrating the preparation of Japanese lacquer and the manufacture of lacquer ware. There are stems of the lacquer-tree (*Rhus vernicifera*, etc.) showing the incisions made for collecting the juice; instruments used for making the incisions, paring the bark, etc.; lacquer in different stages of preparation; dyes and coloring matters; brushes, squares, and compasses used in drawing the designs; and a drying press, in which the work is put to dry. The *Leguminosæ*, again, occupy fifteen cases, one of them being very attractive, with various specimens of Lisbon copal, — recent and fossil, — pebbly copal, African copal, and a fine mass of accra from the Gold Coast; all probably furnished by species of *Copaifera*. The *Umbelliferæ* present curious objects in dry-looking tufts of plants of *Azorella selago* (Hook. §7), very abundant in Kerguelen's Land, where it often covers the ground with dense masses of vegetation. A still denser, harder mass is afforded by *Azorella cæspitosa*. (Vahl.), the bog balsam, a singular feature in the landscape of the Falkland Islands, rising in huge, perfectly hemispherical hillocks, often two to four feet in height, and four feet in diameter. Close to this anomalous umbellifer is a very fine specimen of an equally strange composite, the *Raoulia eximia* (Hook.), which, growing in large, whitish tufts on the mountains of New Zealand, is often mistaken, even at a short distance, for a recumbent sheep; and shepherds have been known to climb up to a mass of it, thinking it one of their laggard flock.

There is also a valuable series of materials, fruits, etc., from the ancient Pile dwellings in the Swiss lakes, and a collection of wreaths and funeral offerings from the tombs of Aahmes, Rameses II., and the Princess Nzi, some of them dating from 1300 to 1700 B.C.

In Museum No. II., among the products of the bamboos and palms, are the gigantic fruits of the coco de mer, or double cocoanut (*Lodoicea sechellarum, Lab.*), a lofty palm limited to three small, rocky islands of the Seychelle group, North-east Madagascar. Prior to the discovery of these islands, in 1743, the nuts had been picked up floating on the ocean, and fabulous stories had been told by mariners respecting their origin. The slender trunk of the palm, twelve to eighteen inches in diameter, attains a height of seventy to ninety feet, surmounted by a crown of fan-like leaves, which, with leaf-stalk, measure from twenty to thirty feet in length. The fruit, resembling two, or even three or four, cocoanuts joined together, sometimes weighs forty or fifty pounds.

In Museum No. III. may be studied the timber resources of various countries in every quarter of the globe. From New Zealand are fine planks of woods suitable for structural or building purposes, and choice specimens for ornamental cabinet work; and, a mere curiosity, for its wood is soft and useless from an excess of gallic and tannic acid, is a specimen of the kohuterhuter (*Fuchsia excortica*, Lin. *fil*), a large bush or small tree ten to thirty feet high, with a trunk sometimes three feet in diameter. Australia, largely represented by her acacia and eucalyptus woods, exhibits a group of grass gum-trees (*Xanthorrhœa quadrangulta*, F. Muell), — singular plants belonging to the *Juncaceæ*

or rush family. The flowers are borne on slender spikes, often three or four feet long, starting from among the crown of leaves at the summit of the stem. The species are often known in Australia as black-boy trees, in consequence of the fancied resemblance of the trunk and flower-spike at a distance to a native holding a spear.

Down the centre of the room are glazed stands containing a series illustrating the manufacture of articles of wood such as that of violins at Munich, and of children's toys for Noah's arks, as carried on in Saxony. For these the rough design of the animal required for representation is first turned in a circular piece of wood by the lathe; sections are then cut out, and very little handwork produces from the same circle a sheep or a wolf, a horse or an elephant.

On the ceiling is a representation of *Amorphophallus titanum* (Becc.), a gigantic aroid, native of Sumatra, whose three-parted, compound leaf rises to the altitude of a tree, while the blossom, a burden for two men to carry, rises from the root with spathe and spadix, after the fashion of our Indian turnip.

But one does not go to Kew for study only, and some time must be given to the mere enjoyment of the beauties of tropical and temperate vegetation as offered in the palm-house, conservatories, and various houses for tree-ferns and water-lilies, and in the Gardens themselves and the extensive arboretum. Here old trees spread their branches with a luxuriance that speaks of a century of careful guarding, and avenues and vistas of young ones promise a continuation of beauty for the future. Pines, spruces, firs, and yews, the cedar of Lebanon, the deodara of India, and California sequoias, all thrive at Kew as heartily as native trees, and in their own natural beauty, and the added beauty of their surroundings, form pictures never to be forgotten. The Royal Botanic Gardens at Kew are indeed a paradise to the lover of nature, and fain would he linger indefinitely among their treasures.

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[Original in *Popular Science News.*]

THE TENDENCY OF MATTER AT THE SURFACE OF THE EARTH.

BY W. A. ASHE, F.R.A.S.

PART I.

It is a very popular belief, and one that is taught in all elementary text-books bearing on the subject, that matter at the surface of the earth has a tendency towards the poles; because, as it is said, of the greater value of gravity there. That this belief is held by others than the unscientific, the following quotation from Mr. Proctor's "Saturn and his System" will sufficiently prove; and it will serve to point out how general and unquestioned this belief is as well. He says, "It appears probable that fluid masses at the surface of such a planet would tend to form two vast polar oceans, since gravity is so much greater at Saturn's poles than equator."

Mr. Proctor is, of course, speaking of the tendency of matter at Saturn's surface; but the conclusion is equally applicable to the case of any heavenly body having a motion of rotation and, presumably, compression, as pointed out in the first part of the quotation used. It is evident that this tendency is attributed to the fact of Saturn's polar being less than its equatorial diameter, although the statement is made as if the effect were produced by reason of the single fact of gravity being greater at the poles than equator, — a characteristic that belongs to every rotating sphere, and which we know, at least in the first place, does not produce a poleward tendency; for it is by means of this motion of rotation that a sphere is transformed into a spheroid, by the transferrence of its particles, under the influence of gravity and the centrifugal force that has by this means been generated, from about the poles towards the equator; so that we are justified in assuming that the mere fact of gravity being greater at the poles than equator is insufficient of itself to produce a tendency in this direction. There are other circumstances, as we shall presently see, that require to be considered before we can predict the direction of the tendency of matter at the surface of any rotating solid.

It may aid towards the general understanding of the fallacy contained in this very popular belief and Mr. Proctor's statement, to express his conclusion in the following way: "If a sphere is caused to rotate about an axis, we know that an oblate spheroid will be developed if the particles forming its mass are free to move; if not, that there must be a tendency in the direction of that solid, as the result of the forces now acting upon it; but once this solid has been developed, or partially developed, should viscosity or any other cause prevent its being fully so (the possibility of the spheroid being over-developed not being at present considered), then the particles of its matter will move, or have a tendency to move, back to the outline of the perfect sphere, in opposition to the still existing forces that they moved in response to in acquiring their present position."

If we consider such a section of the sphere and spheroid as would be represented by the circle and ellipse, it would seem evident that any fluid mass on the latter must have a tendency to move towards the poles or minor axis, because of the very evident "down-hill" course it would be following in moving in this direction; but it is just on what we mean by the term "down hill" that every thing depends. If, in the sphere or spheroid, we consider that direction as downwards which approaches nearer the centre of gravity than the other, then, certainly, would matter have a tendency towards the poles in the case of the earth or any other similar figure. This is a correct definition of the term "downwards" in every case that we may consider, in which the body is assumed as being at rest; but, once a motion of rotation is given to it, our horizontal plane, or plane of reference, is so altered in position, that what may have been downwards in one case need not be so in the other. As an illustration, let us consider the case of a sphere at rest, covered with a film of water. In this case we know that there will be uniform distribution of the film over the whole surface, chiefly because the action of gravity is everywhere at right angles to the surface of the sphere about which the waters are distributed, or to the horizontal plane. Now, if our sphere acquires a motion of rotation, a new force is brought into existence (the centrifugal force), which, acting in a direction different to that of gravity (except at the poles and equator), produces a resulting tendency to movement in matter, which is in every case different to that it would have had, had it been acted upon by the force of gravity alone. The angular difference between the direction in which gravity aloue would have acted, and that in which the combined influences of gravity and the centrifugal force are acting, is called the "angle of the vertical;" the plaue at right angles to this combined influeuce, at every point of the surface of our solid, the "horizontal plane;" and, only by knowing the difference between this and the actual surface of the solid we are considering, is it possible to state what direction on the mean surface of our solid is to be considered "downwards." Thus, it will be seen, that, to predict the direction of the tendeney of matter at the surface of any rotating solid, we must consider, in connection with the visible outline it presents, what the resulting direction of the combined action of gravity and the centrifugal force is with reference to the surface; and, as this resulting direction depends entirely on the value of the centrifugal force (which is itself dependent on the rate with which the solid is rotating, or its diurnal motion), it is essential that in considering the resulting tendency of matter at the surface of any solid, we should remember that all such considerations as to whether gravity is ever other than greatest at the poles, or whether the polar or equatorial diameters are the greater, are insufficient of themselves for the determination of the question proposed. Invariably, no matter what the apparently exaggerated outline of the solid we are considering, if that outline is the natural development of one solid into another, the existing condition must be more nearly one in which the particles of its matter are at rest, than was that of the first; and, failing their having reached the solid of equilibrium corresponding to the existing forces, owing to their motion having been arrested whilst proceeding in the required direction, then their tendency must be in the direction of that original motion, or towards the equator; so that, were their ability to move increased, this would be the direction of their movement.

(*Concluded next month.*)

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[Special correspondence of the *Popular Science News.*]

PARIS LETTER.

The principal scientific event of late is the meeting which has been held of the Congrès pour l'Étude de la Tuberculose in Paris. The initiator of the project was Professor Verneuil, and the meeting was presided over by Professor Chauveau, the well-known physiologist. The second meeting is to be held two years hence under M. Villemin's presidency. M. Villemin is the pioneer of the recent notion of contagiousness and of the infectious nature of tuberculosis, and his part in the advance of science has been a very great one.

Many interesting papers have been read, but none of any very great importance, — none that are epoch-making at all. M. Nocard, of the Paris Veterinary School, gave some useful information concerning the danger of the milk and meat of tuberculous animals to the health. Although the milk of a tuberculous cow contains tuberculous bacilli only in the case of local mammary tuberculosis, the Comité des Epizootrés has forbidden the sale of the milk of such cows, and allows it to be used *in situ* and for animals only, after boiling. Generally speaking, M. Nocard says, that, as it is impossible practically in a large town to ascertain the exact origin of the milk sold in it, the milk, especially for children's use, should *always* be boiled. If unboiled milk were absolutely necessary, one should use goat's milk, as tuberculosis is extremely rare in this sort of animal. Concerning the flesh of tuberculous animals, Bouley was of the opinion that it should be entirely prohibited; and his motion carried the day in a meeting held in Antwerp. But the strict regulations prescribed by this meeting were never enforced; in fact, they were much too strict. Numerous experiments have shown, before and since, that a tuberculous animal is not tuberculous in all its parts, and that the flesh is very rarely so, even when the lungs or viscera are extremely tuberculous. So, in 1885 it was resolved in France to prohibit the sale of the flesh of tuberculous animals only when the tuberculous bacilli are found out of the affected organs or of the corresponding lymphatic ganglia.

When the bacilli are found only in these parts, the flesh is allowed to be sold; the diseased organs

being submitted to entire destruction. At present the general regulations are the following: A tuberculous animal is put apart, and cannot be displaced unless for the purpose of having it killed. Its flesh can be sold for alimentary uses so long as the tuberculosis has been recognized to be local; that is, to be confined to visceral organs and to the corresponding ganglia. The hides are not allowed to be used unless they have first been submitted to disinfection. The milk of tuberculous cows can be used only for animals, after boiling. These regulations are wise, being sufficiently strict for the protection of public health, and keeping quite abreast of the present state of science. M. Nocard communicated some experiments of an important nature, showing that the juice of the meat of tuberculous oxen does not contain any bacilli, and is utterly harmless. It is known, however, that under certain circumstances the blood may contain a number of bacilli. These bacilli are, of course, transported in the whole body, and a large part comes in the muscular tissues. Here, however, they do not remain long; and before a week has elapsed they have been entirely destroyed *in* and *by* the muscular tissues by which they are digested, so to speak. So, upon the whole, the meat of tuberculous animals is to be considered as very faintly or not at all dangerous to public health, and under proper restrictions its sale is to be allowed. Milk when the mammary glands are not tuberculous is not dangerous; but, as one cannot ascertain the exact origin of the milk sold in cities, it should always be boiled, as experiments have shown that the boiling kills all the bacilli. Impure milk makes impure cream and butter, as M. Bang of Copenhagen has seen, and great care must be taken as to the origin of these.

M. Arloing gave some information concerning experiments he is making. He is trying to find a bacillus that is able to kill that of tuberculosis, or a disease that could be inoculated without great inconvenience, and would preserve against tuberculous inoculation. He has tried typhoid bacilli without any success: they seem to render the progress of tuberculosis easier and more rapid. However, he believes something may be found that will prove useful.

The *Revue Scientifique* has published, under M. de Lapparent's name, a good paper on the proposed submarine tunnel between England and France. He is a strong advocate of the enterprise, on commercial grounds, and pronounces the work of an easy realization. The scheme of a bridge he does not relish at all, and thinks the structure would not last long. It is, however, a queer thing to see how the English affect to believe that the tunnel would be a great danger to them, while the notion has never come to the French that it would be one to themselves. No one will believe that there is any difficulty at all in protecting the entrance of such a tunnel, and in preventing an army from coming through it from the opposite side.

Interesting experiments have been recently made in Russia, and published in France, on the culture of vegetal parasites for the destruction of injurious insects. The result is, that, in works specially gotten up for the purpose, spores of *Isaria destructor* have been abundantly and easily cultivated at small cost, and have proved exceedingly useful for the destruction of *Cleonus punctiventris* and other *Coleoptera*, which are very injurious to beet-root. Other vegetal parasites are known that are destined, perhaps, to become some day of great use, such as *Entomophthora grylli*, which kills the genus *Gryllus;* others which have destroyed large quantities of *Panolis piniperda*, etc. In his paper, published in the *Memoires des Naturalistes de la Nouvelle Russie*, M. Krassilstchik gives an enumeration of such parasites, and of the epidemics they have brought on insects, so far as he knows. It may be hoped that many insects that are extremely injurious to fruits or crops could be destroyed by the use of some of these parasites, and be prevented from doing such mischief as they do. If some vegetable could be found that could destroy the Algerian locusts, it would be a public good for France's large colony, which has been this year again visited by the terrible plague.

Two French engineers have projected to build for the Exhibition a large terrestrial globe of forty metres circumference; that is, at the scale of one-millionth. This globe is to be supported on a strong column, on which it will rotate, describing a whole turn in twenty-four hours; and circular galleries around it will allow of an easy inspection. The idea is a very good one, and if properly carried out, — and generally Frenchmen do understand the execution of such plans, — will be a real attraction for all.

M. A. d'Assier, examining the *questionem vexatam* of the earth's age, arrives at the conclusion that it is about half a million of years for the nebular and stellar period, and about twenty-five millions (of which fifteen are passed) for the period of organic beings. When about twenty-six million years old, our mother-earth, cold and lifeless on account of the sun's disappearance, shall be somewhat shaken in consequence of the moon rushing on her, and some time later will in turn rush in the sun. This affectionate meeting, if M. d'Assier is well informed, will cause a momentary outbreak of heat and light, and thus the earth will have done with its troubles.

M. Pasteur read at the last meeting a paper which has been creating a good deal of sensation. This paper is from Dr. Gamaleïa, director of the anti-rabic laboratory of Odessa. M. Gamaleïa claims to have discovered the method of preventing cholera by preventive vaccination. Ordinary cultures of the cholera bacillus are endowed with a very feeble virulency, and M. Gamaleïa says that the first step in the preparation of the vaccination matter consists in increasing this virulency. This is easily obtained by cultivating it in a pigeon after it has passed through a guinea-pig. This strong virus is cultivated in broth, and then submitted to the temperature of 120° Centigrade during twenty minutes, to kill the bacilli. This sterilized culture is very virulent yet, as it contains a substance which kills rapidly the animals which are inoculated with it, although it contains no more bacilli. If this sterilized culture is inoculated in small quantities at different times (twelve cubic centimeters of the broth in two or three doses in as many days, for instance, for the pigeon), it does not kill, but acts as a preventive; and the most virulent culture may be inoculated without causing any choleraic symptoms. M. Gamaleïa claims that his "chemical vaccine" — it is a chemical, without living organisms — confers a complete immunity against cholera. He proposes to come to Paris to repeat all his experiments in Pasteur's laboratory, under the eyes of a special committee of the Academy of Sciences, and to find, by experiments on his own person, the dose that is necessary for anti-choleraic vaccination. This proposal has been accepted, and the Russian scientist is to come in November to repeat all his experiments. The readers of the *Popular Science News* will be kept *au courant* of this very important discovery.

H.

Paris, Aug. 22, 1888.

SCIENTIFIC BREVITIES.

Speed of Electricity. — There is, as Professor Thompson remarks, no assignable "velocity of electricity," as this must vary with the current and the conductor. Wheatstone, in 1833, seemed to show a transmission velocity of 183,000 miles a second through copper wire; but in late experiments signals were sent over ordinary telegraph wires on poles, and had a rate of only 14,000 to 16,000 miles. With wires near the earth, the velocity was 12,000 miles, but reached 24,000 on very high wires.

Application of the Electrolysis of Copper to the Measurement of Electric Currents. — In the process of standardizing Sir William Thomson's new electrical instruments, Mr. Gray has been led to examine the accuracy of the method by means of the deposition of copper, and concludes that the constant of an electric-current instrument can be obtained with certainty, by this method, to one-twentieth of one per cent.

Why do they? — A correspondent of an exchange writes, "Apropos of left-handedness, I should like to see a satisfactory explanation of the fact that women always (with exceedingly rare exceptions) button from right to left, and men from left to right. Personally I have remarked only four cases of exception to the rule."

Influence of Light upon Electrical Discharges. — Hertz, in a previous number of the *Annalen der Physik*, having called attention to a remarkable influence of the ultra-violet rays upon electrical discharges, E. Wiedemann and H. Ebert repeated his researches, and have confirmed his results. When a spark will no longer pass between the terminals of a Ruhmkorff coil, if a beam of ultra-violet light falls upon the electrodes, the spark will traverse the interval between the electrodes. Wiedemann and Ebert show that the effect is also produced by the light of burning magnesium, and that the effect is confined to the ultra-violet rays, red and green producing no effect. The effect is produced at the negative electrode, and not at the positive.

In testing Chemically Certain Filaments said to be of a material other than carbon, Mr. Desmond Fitz-Gerald boiled them in strong sulphuric acid, with the view, if carbon were present, of obtaining carbonic oxide and sulphurous acid according to the reaction

$$H_2SO_4 + C = CO + H_2SO_3.$$

No such reaction occurred, the filaments in question remaining unaltered. Before committing himself, however, to the conclusion that no carbon was present, the experimenter took the precaution of repeating the experiment with filaments known to be of carbon. These filaments also remained unaltered after prolonged boiling in the acid. This result justifies the conclusion that the carbon of lamp filaments, unlike ordinary carbon, is not acted upon by sulphuric acid at its boiling-point.

The Duration of Lightning Flashes is obtained by observing the heating effect produced upon some substance through which we know the whole of the flash has passed, and comparing that effect with the effects produced in a laboratory by the passage through the same kind of substance of a known current of electricity for a known time; then, by observations upon the duration of lightning flashes, we can calculate the quantity that must have passed in order to produce the observed effect. Thus, it is reported that in 1772 lightning struck a bar of iron on the top of the dome of St. Paul's and made it red-hot. The bar was four inches broad and one-half inch thick. Wheatstone estimated, by means of his revolving mirror, that the duration of a flash certainly does not exceed the millionth part of a second.

Practical Chemistry and the Arts.

NICKEL AND COBALT: THE TWIN METALS.

About the middle of the last century two new metals were discovered at nearly the same time, and so closely related to each other that they may appropriately be called the twin metals. Nickel and cobalt are the only two elements known which possess the same atomic weights; for although the latest investigations seem to show a slight difference in this respect between them, yet it is in any case only a fraction of a unit, and the number 59 is apparently the nearest certain determination yet made of the atomic weight of either.

Dr. Crookes remarks that so close is the similarity between these metals, they might even yet be considered one substance if certain of their salts were not differently colored; and every student of chemistry knows that their complete qualitative or quantitative separation is a most difficult and unsatisfactory task. Both are magnetic, especially nickel; in this respect, as in some others, resembling iron.

Cobalt is of considerable value in the arts, on account of the brilliant and permanent colors of some of its salts. When a compound of cobalt is fused with silica and potash, a glass of a magnificent blue color is formed, known as smalt. This is finely pulverized, and used as a pigment. It has lately been replaced, to a considerable extent, by the cheaper artificial ultramarine; but, unlike that substance, its color is not bleached by acids. Salts of cobalt are also used to obtain a blue color in glass and china painting.

Cobalt yellow is a nitrite of cobalt and potash. It is one of the few salts that can be prepared free from nickel and other impurities, and on this account is important from a chemical stand-point.

Nickel is a much more valuable metal than its associate. It has a brilliantly silver-white color, is stronger than iron, has great resistance to chemical agents, and does not rust when in contact with air or water. It forms with other metals many valuable alloys, including the well-known german silver, — an alloy of copper, zinc, and nickel. Some of the smaller coins of this country are composed of nickel and copper. Laboratory vessels of pure nickel have recently been introduced, and for many purposes are a cheap and satisfactory substitute for platinum.

Metallic nickel is usually sold in the form of small cubes. The oxide of nickel is first prepared and made into a paste with oil, starch, charcoal, and other reducing substances. The cubes are formed from this paste, and strongly heated, till the oxide is reduced. The metallic nickel does not melt, but sinters together till the resulting mass is quite compact.

The most important use of nickel, however, is in the art of electroplating. By this means a bright silvery coating may be deposited, which will not tarnish or rust. The process is the same as in silver or gold plating. A solution of a nickel salt is prepared, and the article to be plated is attached to a wire carrying an electric current, and immersed in the solution. A plate of nickel is attached to another wire connected with the same electric circuit, and also placed in the solution. As the current passes through the liquid, metallic nickel is deposited in an even coating, which may be made of any desired thickness, and only needs a slight polishing to give it the familiar brilliant lustre.

To the chemist the occurrence of these twin metals, so nearly alike, and yet perfectly distinct forms of matter, suggests many interesting questions. We can no more change nickel into cobalt than we can transform mercury into gold, as the old alchemists claimed. Still, we cannot help thinking that the almost identical chemical and physical properties may be a hint of a possible evolution, in some distant period of the history of the universe, of the different elements from one primordial form of matter, in which the differentiation of cobalt and nickel was, by some unknown cause, arrested at an earlier period than that of the more dissimilar metals. Whatever this process of evolution may have been, it certainly ceased long ago, and the elements remain unaltered as they came from Nature's laboratory. In the ever-widening field of spectroscopic analysis we have already found some help towards the solution of the problem, and it may not be many years before the whole matter will be made clear to us.

KERKOOK PETROLEUM SPRINGS, ASIA MINOR.

On the eastern side of the Tigris, in the neighborhood of Kerkook, are numerous petroleum and naphtha springs which furnish employment for many of its people. The most abundant supply is obtained from the hills around, but a good deal is collected on the surface of the water in the ditches and stagnant pools. Some years ago this petroleum was largely used in Bagdad and Bussorah; but, as the natives do not understand how to refine it properly, it has of late years been superseded by Russian and American oil. If the proper scientific methods were used in refining it, it is probable that the oil from this region might become of great commercial importance, as it is inexhaustible in quantity, and, even without a railroad, transportation is easy by way of the Tigris and Persian Gulf to Bagdad, Bussorah, India, and beyond. There is, it is said, no limit to the supply which might be procured from the hills about Kerkook and Arbela. These have been yielding bitumen and petroleum since the time of Alexander the Great at least, in whose honor Arbela was illuminated after his great victory over the Persians. The petroleum springs from almost every hollow in the hills. As it rises from the earth it is of a brownish color with a greenish tinge. It quickly becomes opaque and hard, in which state it is easily broken, with a shining, resinous fracture. The natives use it for fuel to burn limestone, and also to cover boats with. The boats which are covered with this substance look as if they were covered with a thick hide Mr. Grattau Geary thus describes the principal spring, a funnel-shaped hollow ten or twelve yards in diameter: "The hollow is filled with a dark blackish-brown substance, from the centre of which salt-water bubbles up, and escapes to some salt-ponds, where, evaporating, its saline matter is left behind. Sometimes the water rises at intervals from the centre in jets a foot and a half high, and at others it bursts out in a considerable volume, raising the petroleum into huge bubbles, which burst, and let the imprisoned water out with a gurgling noise. The pit is very deep in the centre, but its shallowness at the edges permits the people to stand in it up to their knees, while they with facility roll up the tenacious substance into masses which are carried away and placed to dry in the heat of the sun. When hardened it is used chiefly for fuel for the burning of limestone. The flames give a strong light and heat, and it leaves a small earthy residue after it is burned. Notwithstanding the quantity that is constantly drawn off, the petroleum always continues at the same level, and the Hittites say the supply in the pit is inexhaustible. The fluid skimmed off the water in the ditches and marshy places in the neighborhood of Kerkook is of a blackish-green color, and smells abominably." — *Engineering and Mining Journal.*

WINDMILLS FOR ELECTRIC LIGHTING.

"Some time ago the possibilities of windmills for domestic electric lighting were mentioned in this journal, and lately the experiment has been practically tried. Professor Blyth read before the Glasgow Philosophical Society a paper on the subject, in which he describes an experiment which he made last summer, — the lighting of a cottage in which he spent his vacation by a dynamo driven by a windmill, and charging a storage battery. The windmill used was an old-fashioned style, with four arms at right angles to each other, each of them thirteen feet long. There was no especial regulating device. The dynamo was belted directly to the fly-wheel of the mill, and charged twelve cells of storage battery, which supplied the incandescent lamps in the cottage. Professor Blyth had never used more than ten lamps at once, but he could have used more. With a good breeze, enough electricity could be stored in half a day to supply light for four evenings of three or four hours each. The lamps used were of eight-candle power. When charging, the current passed through a cut-out that would disconnect them from the dynamo when it ran below a certain speed: so the windmill could be allowed to run all the time, charging the battery when the wind happened to be strong enough. The current had been used to run a light turning-lathe, and Professor Blyth had begun to make a light carriage to be run by the stored electricity. The paper opens to us a field for ingenuity, comfort, and amusement in our homes. Windmills much superior to that described can be readily purchased, a small dynamo can be bought or built at little cost, and storage batteries can be purchased or made. With them we could light our house economically; our light would be better, cooler, and healthier than gas or coal-oil lamps; while the current could be utilized for running fans, sewing-machines, etc. Indeed, to the average American, with some spare time and some small ingenuity, the amusement and instruction of such a plant would more than pay for its expense." — *Science.*

ASSOCIATION OF HYDROCARBONS WITH ROCK-SALT IN NATURE.

The frequent association of salt and bitumen or petroleum in the same deposits has often struck me as likely to lead to the development of some probable theory as to the formation of these hydrocarbons. Almost all specimens of rock-salt, when

struck or rubbed, give off more or less the characteristic odor of bitumen. Beds of rock-salt are often colored brown by the bitumen they contain; and petroleum, on its emergence, is nearly always associated with brine. Deposits of rock-salt are, as a rule, dry and anhydrous, though salt itself has a considerable attraction for moisture. But, more than this, those salts of potassium and magnesium often occurring with it, are still more greedy of water.

If the seemingly probable theory that all formations of rock-salt are due to the evaporation of sea-water be correct, then these deliquescent and hygrometric chlorides would almost always have been the last part deposited in every bed of rock-salt; and though, owing to their great solubility, they may have been denuded and washed or melted away, perhaps long afterwards, it is probable that they generally formed the final layer at first. These would, by their affinity for water, both during their formation and subsequently, tend to withdraw that liquid from all surrounding substances.

Now, most organic matter may be looked upon as a hydrocarbon combined with the elements of water. Withdraw the water, and the hydrocarbon remains. Metallic iron, if present, might modify the reaction. Is it not, then, a probable theory that most natural deposits of hydrocarbons owe their origin to this absorption of water, acting through the lapse of ages on organic matter, often aided by heat and pressure? If such be admitted, it would account for the frequent association of salt with hydrocarbons. — F. Maxwell Lyte, *in Chemical News.*

A USEFUL TABLE.

The *Universal Tinker* gives the following table showing the capacity in gallons for each foot in depth of cylindrical cisterns of any diameter, which may be of value to some of our readers: —

Diameter.	Gallons.	Diameter.	Gallons.
25 ft.	3,059	7 ft.	239
20 ft.	1,958	6½ ft.	206
15 ft.	1,101	6 ft.	176
14 ft.	959	5 ft.	122
13 ft.	827	4½ ft.	99
12 ft.	705	4 ft.	78
11 ft.	592	3 ft.	44
10 ft.	489	2½ ft.	30
9 ft.	396	2 ft.	19
8 ft.	313		

THE ANILINE INDUSTRY IN GERMANY.

From the United States consular reports on the condition of Germany in 1887 we make the following extracts concerning the aniline industries of that empire: —

"The restless spirit of investigation, called into being because of close competition, is leading day by day to new and sometimes startling discoveries in the world of chemistry. The old is ever giving place to the new. Dyes which sold at dollars per ounce yesterday, are offered to-day at the same price per pound. The mine of wealth so often discovered in the chemist's crucible or laboratory surpasses the dreams of men searching the secrets of gold-making To find dyes capable of resisting the influences of sunlight, and resisting the dissolving influences of water, is to find the pathway to wealth. The aniline works here in Germany have been making such discoveries. Old dyes are giving place to the new. Azo dyes have sold very well during the year just closed; this is especially true of those cotton dyes the secret of whose manufacture was discovered in 1885. A series of indefatigable efforts has resulted in producing a number of these particular dyes in yellow, orange, cherry, red, violet, and blue, to meet the rapid demand for which the producing capacity had to be enlarged. The products being well protected by letters-patent, and the producers enjoying a monopoly, the profits have been very large. Certain colors, long desired, seem at last to have been obtained. The principal part of the aniline colors is sent to the United States, England, Russia, and other Continental countries, and to China, Japan, India, Australia, and South America."

RAILROAD NOTES.

The Garabit Viaduct on the new railway line Saint-Flour-Neusargues, in the Auvergne, France, one of the most daring and interesting engineering works of the present day, has just been opened for traffic. The central span of the viaduct is four hundred feet above the bottom of the valley below. It has been built by M. Eiffel, the well-known engineer, who is now constructing the Paris "Tower of Babel" Before being taken in use, the viaduct was subjected to the severest tests.

Train Mileage in America and Europe. — For every thousand inhabitants the United States runs trains 9,700 miles annually; while the train mileage of Great Britain on the same basis is 7,500; Belgium, 4,500; France, 3,550; and Germany, 3,250. The lesson drawn from this is, that, where people are allowed to pay for railroad service in any way they can, they will have plenty of it; and where they are limited by iron-clad schedules, as in Germany and Belgium, the railroads will give only just as much service as is profitable under such conditions.

The Longest Tangent in the World. — The new Argentine Pacific Railroad from Buenos Ayres to the foot of the Andes has on it what is probably the longest tangent in the world. This is three hundred and forty kilometers (two hundred and eleven miles), without a curve. In this distance there is not a single bridge, and no opening larger than an ordiuary culvert, no cut greater than one meter in depth, and no fill of a height exceeding one meter. There is almost an entire absence of wood on the plain across which the western end of the road is located. This has led to the extensive use of metallic ties, which will be employed on nearly the entire road.

Preventing Noise on Elevated Roads. — Berlin engineers have adopted two different systems for diminishing the noise of trains on their viaducts. One is, to bolt to the bridge-structure long troughs of sheet-iron, about sixteen inches wide, so arranged that a rail will come in the centre of each. The troughs are then filled with gravel, in the middle of which is buried the longitudinal timber carrying the rail; and the space between the troughs is covered with iron plates, on which is spread a thin layer of gravel. The second method, which is found to be more efficient than the other, consists in placing a continuous series of shallow iron troughs, about five feet square, along the line of the tracks. These are filled with gravel, on which the ties and rails are laid.

English and American Railroads. — An experiment made to test the respective railroad operations of England and this country shows that on the Pennsylvania Railroad each locomotive does upward of six times the work, runs annually nearly twice the mileage, and, with less than one-half the charges for traffic, earns nearly twice the revenue that one does on the London and Northwestern Railway. As a general rule, English lines are far better constructed than American, — the gradients are easier, and the curves less abrupt, — and yet in the two lines above specified the English locomotive costs, in repairs and renewals, about double the American for the same amount of work performed

Building a Locomotive in Seventeen Hours. — The record in rapid machine-work has again been lowered. Heretofore the Baldwin Locomotive Works of Philadelphia have held the first place, with the record of an engine built in twenty-four hours; but the Pennsylvania Railroad Company has now taken the palm by constructing a full-sized (110,000 pounds) anthracite-burning locomotive at the Altoona shops in sixteen hours fifty-five minutes. The work was commenced on the morning of the 18th of June, and in five minutes less than seventeen hours the engine was turned out ready for use. It is to run on the New York division of the Pennsylvania Railroad. This feat is, we believe, quite unrivalled in locomotive building.

INDUSTRIAL MEMORANDA.

Pencils. — According to Johann Faber, the famous manufacturer of Nuremberg, the people of the United States use, in round numbers, about a hundred million lead-pencils every year.

Steam-Heating. — Rule for finding the superficial feet of steam-pipe required to heat any building with steam: One superficial foot of steam-pipe to six superficial feet of glass in the windows, or one superficial foot of steam-pipe for every hundred square feet of wall, roof, or ceiling, or one square foot of steam-pipe to eighty cubic feet of space. One-horse-power boiler is sufficient for forty thousand cubic feet of space.

A New Electric Organ has been erected at the back of the stage of the Burg Theatre, in Vienna, and is connected by a cable with the orchestra, where the key-board is situated. The cable is long enough to admit of altering the position of the key-board within a radius of thirty feet. The signals are transmitted from the key-board to the relay lever by five Callaud cells.

Soapstone Paint. — Soapstone incorporated with oil, after the manner of a paint, is said to be superior to any kind of paint as a preservative. Soapstone is to be had in an exceedingly fine powder, mixes readily with prepared oils for paint use, covers well surfaces of iron, steel, or stone, and is an effectual remedy against rust. It has been known to protect some stonework, such as obelisks, in China, for ages past. The writer who calls attention to this is a scientific expert of London, who has noticed the use of this Chinese soapstone in Chiua, and has been experimenting with it since his return to England.

A Quick Trip. — The outward passage of the steamship "Ormuz" is distinguished by being the fastest ever made to the antipodes, her ocean steaming-time from Plymouth to King George's Sound being twenty-five days six hours, notwithstanding the fact, that, with the exception of two days, strong head winds and seas were experienced all the way from Aden. The speed averaged from the time of taking the mails on board at Suez till landing them at Adelaide was upwards of fifteen and three-quarters knots, and the best day's run was equal to seventeen and one-half knots.

Triple Screw Propellers. — The Italians have made use of a new principle for the propulsion of some of their fast gunboats and torpedo catchers under construction. They have improved on the twin screws of modern steamships by the addition of a third screw moved by a separate shaft and set of engines. The three screws are placed in the angles of a triangular pyramid. There is one on each side of the rudder, as usual; and the third is underneath, on a level with the keel plate. It was claimed that the third screw increased the vessel's speed by fully a third, on account of the great gain in power from the deep immersion.

Home, Farm, and Garden.

ORCHIDS.

The orchid family of plants is very large and widely spread. Nearly all the species are distinguished by some striking peculiarity of form, color, or fragrance; and the great beauty and brilliancy of certain varieties have caused them to bring enormous prices. A variety of *Catleya* — quite a common species — was recently sold at Paris for about two thousand dollars; the only reason for this enormous price being, that the corolla was of a blue color, slightly tinted with violet, instead of the usual reddish violet. A rare variety of *Cypripedium* — the common lady's-slipper or moccason-flower of this country — brought at a sale in Ghent the sum of twelve hundred dollars; and numerous other similar instances have been noted, recalling the days of the tulip mania in Holland.

We copy from *La Nature* an engraving of a bouquet of these flowers arranged by a French florist, which, however, gives only an imperfect idea of the beauty of the living flowers. They do not fade quickly, and are well suited for bouquets and decorative purposes. One of the most remarkable varieties is the *Oncidium papilio*, the flower of which is borne at the end of a long stalk, and exactly resembles a brilliantly colored butterfly with outspread wings.

Not all the orchids are sold at as high a price as those mentioned above. Many equally beautiful ones can be procured of the florists at very reasonable rates. Some species belong to the class of air-plants, and only need a piece of wood or bark to attach themselves to, with plenty of moisture, and will flourish with little care. The cultivation of orchids is rapidly becoming a favorite pursuit with amateur gardeners and horticulturists, and we may expect to see them more common and plentiful every year.

Although the most showy and brilliant orchids are inhabitants of tropical forests, there are many interesting species growing in our own fields and woods. The pretty lady's-slipper and graceful arethusa belong to this family, as well as the showy-orchis and the less conspicuous coral-root and putty-root. A very common orchid is the little flower known as lady's tresses, which grows abundantly in damp places. The small, whitish flowers are arranged spirally around the stalk like a curl of hair, and are very sweet-scented; in fact, if any flower has any remarkable peculiarity of shape or color, it is quite probable that it may prove to be an orchid.

The botanical relations of this family are very important and very complicated. The stamens and pistils are united together, forming what is known as the *column*. The pollen grains usually cohere together into masses, and the different arrangements of the flower by which cross-fertilization, or the deposition of the pollen of one flower upon the pistil of another, are extremely wonderful. This is usually effected by the aid of bees and other honey-loving insects, which, attracted by the appearance or odor of these conspicuous flowers, enter the corolla, and bear away the sticky pollen masses upon their bodies. When the next flower is visited, the insect is obliged by the shape to enter it in such a way that the pollen on his body is brought in contact with the stigmatic surface of the pistil, to which it adheres.

This interesting matter of cross-fertilization is treated of at great length in the works of Darwin, Gray, and other naturalists, and has an important bearing upon the evolutionary theory. Why cross-fertilization is of benefit to the plant is unknown; but such seems to be the case, although there are a few instances, as in the case of the common blue violet, where only the self-fertilized flowers, or those where the pollen of the same flower is deposited upon its pistil, produce fully developed seeds. So important is cross-fertilization in some cases, that in Australia it was found impossible to raise clover-seed until the farmers introduced bees who could insert their long tongues into its deep tubular corolla, and carry the necessary pollen from one flower to another.

The cultivation of orchids presents no especial difficulties, and can be recommended to the attention of both the scientific botanist and the amateur horticulturist.

[Original in *Popular Science News.*]

THE OAK-PRUNER.

BY W. J. CHASE.

The attention of many of the readers of the *Popular Science News* has undoubtedly been attracted recently to the ravages of some insect which causes the tips of the branches of the oak-tree, and oftentimes large branches themselves, to fall withered to the ground. The insect which is doing this mischief is the oak-pruner (*Stenocorus putator*), the most interesting of all the thirty-five or forty insects which prey upon the Northern oak. The larva of this beetle, which is itself not more than two-thirds of an inch in length, displays in its methods of destruction an ingenuity and judgment wonderful to see.

About the last week in June the female deposits its eggs, one at a time, at the axil of a leaf-stalk or near the end of a small twig, and sometimes in the bark of the larger branches. When the grub hatches, which occurs very soon, it eats its way to the centre of the twig or branch on which the egg was placed.

Up to this time it has shown no especial genius, but its work is all before it. The feat that it has to perform is to cut off the limb in which it is located, and with which it wishes to be carried to the ground, without being crushed at the moment the limb breaks away from the tree, or being shaken by its fall from its hole in the branch. To do this successfully would seem to require a very considerable knowledge of the force of the winds, and the size and weight of the part to be severed. Yet, working from the inside, and in the dark as to all of these seemingly necessary data, it must nevertheless calculate just how far it can sever the wood so as to allow itself time before the fall of the branch to retire within its hole, and close the opening with a wad of woody fibre. This, thanks to the many trials, mistakes, and failures of its ancestors, which have their fruit in what we term its instinct, the little pruner seems enabled to do; and, having done it to its satisfaction, it takes its ease, and grows fat upon the pith of the branch, extending its burrow ten or twelve inches beyond the point at which it has been cutting.

If, perchance, a wind of sufficient strength does not blow when expected, the grub returns to the work of cutting, and, having removed a little more of the wood, retreats to its burrow as before. Before very long the expected wind comes, and down falls the branch, with its tenant snugly encased. After its fall it continues to feed upon the pith and fibre, until it has attained its full size, which generally happens about the last of September. Then it goes into the pupa state, from which it emerges a full-grown beetle, either that fall or the next spring.

According to one authority, not only the branches, but small trees, of the white oak are sometimes felled by these insects; in which cases the grub, instead of cutting the wood off transversely, severs it in a slanting direction.

If one of these branches be picked up and examined not many days after its fall to the ground, the grayish grub, with its large head and strong-cutting jaws, will be discovered, still at work devouring the woody fibre. This discovery suggests the way in which to put a stop to the disfigurement of our oaks and littering of our lawns with the twigs; for if at this time the branches are collected as they fall, and burned, the ravages of this insect would soon be materially lessened.

Providence, R.I., *Aug.* 15.

TOILET RECIPES OF ANCIENT EGYPT.

Curious hair-recipes occur on some of the papyri, some of which are very absurd. One to prevent the hair from turning gray directs that a salve should be made from the blood of a black cat cooked in oil; in another, that of a black bull is preferred for the same object. Evidently the color of the animal was to pass through the salve into the hair. In another place we read of the tooth of a donkey dipped in honey being used for *really* strengthening the hair; and the ingredients for an ingenious compound are given for injuring the hair of a rival, and the counter-remedy to be used by those who think their hair-oil has been tampered with by a suspicious *friend*. Cakes of some composition which absorbed oil were always placed on the heads of the guests at feasts, and from them the oil gradually trickled down through the hair. A most disagreeable practice this may seem to us, but to them it appears to have given great pleasure; and with the Egyptians as well as with the Hebrews oil was symbolical of joy and gladness. Rouge and other coloring substances were used by women of Egypt to enhance, as they thought, their beauty. The eyes had often a green line underneath them; the eyelashes and eyebrows were pencilled; and, as in modern Egypt, the nails were always stained red with a preparation from the henna-plant. In our museums we can see the little pots and vases formerly filled with these unguents and colors, and the pencils they used with them, as well as various sorts of combs and hairpins; of the latter there is a very pretty set in the museum at Boulak, — single-pronged wooden pins with jackal heads, stuck into a cushion in the form of a turtle, which was evidently one of the favorite dressing-table ornaments belonging to the deceased lady.

All these little essentials of the toilet were placed in the tombs by the loving hands of friends and relations for the use of that spiritual body which they believed required all the adornment the lady had loved upon earth.

Notwithstanding the elaborate care lavished by the Egyptian lady on her personal adornment, she adopted a simplicity of dress suitable to the climate in which she lived. Except for the wig, the head was usually uncovered, with sometimes a colored band tied round it. The queens often wore the vulture head-dress, but this was more as an official ornament than as a covering. In common life also the women, both of high and low degree, went barefoot, though they had sandals to wear when they were in full dress. These sandals were made of papyrus or palm fibre, or of leather. They had straps to pass around the foot and between the toes, and in some a piece of the sole was turned up, and bent over the toes to protect them; in later times some of the leather sandals had sides to them, which causes them very much to resemble modern shoes. — *The Woman's World.*

[Original in *Popular Science News.*]

THE RAPID DEFOLIATION OF TREES.

BY FREDERICK LEROY SARGENT.

The phenomenon of rapid defoliation in the fall is one which may be often observed in our common trees. The causes at work are not a little mysterious; but some understanding of them may be gained by considering the method of formation of the separating cork-plane, already described in *Popular Science News*, vol. xxi. No. 3, p. 35. This cork-plane begins to be formed sometimes as early as the summer, and by autumn extends almost entirely across the leaf-stalk. All that is needed to insure complete severance is the formation of a few more cells, and the ripening of the whole into a readily separable condition. A sharp frost seems to hasten this final process in a very effectual manner; for, so far as we have observed, it is just after a "cold snap" that we have the most marked defoliation. The exact way in which sudden cold acts to put all parts in readiness for the separation is not clear, but it may be fairly surmised that its effect is felt not so much in the production of new cells as in the ripening of those already formed. All who have prepared specimens for an herbarium, know that, with many plants, the leaves separate from the stem spontaneously during drying. This shows clearly that cold is not necessary to the process of defoliation, and leads us to make the suggestion that it may be a dryness that comes with the cold, rather than the temperature itself, which gives the final touch.

GLEANINGS.

If you feel tempted to swear at the cow, dip a quart of milk out of the pail and pour it on the ground. The effect will be the same, so far as the loss is concerned; but your moral nature will be the gainer.

For Fattening Cattle, especially to increase the production of milk in cows, it is asserted that the pressed cake from cotton-seed gives the best results; the next in good results is the pressed cake from peanuts. No other kind of food seems to equal the two mentioned for milching-cows; the milk results being greater in amount, and richer in quality.

Manurial Value of Nitrogen from Different Salts. — Herr G. Klein has described some experiments on the comparative manurial value of nitrogen in form of ammonia salts and Chili saltpetre. The experiments were made in four localities. In three of them the soil was limy and rich in humus, while the fourth was rich in lime and poor in humus. These were all dressed with phosphoric acid and kainite; and plots were arranged without nitrogenous manure and with nitrate of ammonia, or both. With the first three soils the action of the manure was about the same, but with the fourth soil the nitrate was much more effective than the ammonia salts. This failure of the ammonium salts is chiefly owing to the lime in the soil, late sowing, and unfavorable weather.

The Western Cattle Trail. — The last vestige of the famous cattle trail from Texas to the North, it is said, will soon be wiped out. This trail was six hundred miles long and one mile wide; and when the original survey of Colorado was made, this strip was left for the use of the cattlemen. Hundreds of thousands of cattle have been driven along the trail; but the railroads have rendered it useless, and it is now to be thrown open to settlement.

Barnyard Waste. — The heavy, driving rains often carry away from the barnyard a deep stream of valuable fertilizing material, which is irretrievably lost. This may be prevented by keeping the yard well scraped up, and the contents carried out promptly to the fields, and spread. There they are safe from leaching and waste, and there they will do the most good. Neglect of this liability to wash out the best part of the contents of the barnyard is often one of the great leaks of the farm, and yet it is one which may be easily prevented.

Transplanting Large Pines. — Pine-trees six inches diameter at the base and twenty-five feet high can be moved if sufficient root be taken out; and to do this, cut back the tree some, both at top and ends of branches, and in August or September dig a trench around the trees, say four or five feet from the body, and dig below the roots, cutting them off. Leave the trees until the ground is thoroughly frozen in mid-winter (having, however, holes dug for their reception before winter sets in), and then dig under and raise them out with levers upon stone boats, and transplant, packing the ground solidly around them.

Curiosities of Plant-Life. — It has been shown by Professor Schubeler, a Norwegian plant geographer, that most plants in high latitudes produce much larger and heavier seeds than in warmer regions near the equator. This effect he attributes to the prolonged influence of sunlight during the long summer days of the high latitudes. The difference in seed development was very remarkable in some cases. Dwarf beans taken from Christiana to Drontheim — less than four degrees farther north — gained more than sixty per cent in weight; and thyme from Lyons, when planted at Drontheim, showed a gain of seventy-one per cent. The grain of Northern fields is heavier than when it grows in more Southerly localities, and seed from Norway planted at Breslau decreased greatly in the first year. The leaves, also, of most plants are larger and more deeply colored in higher latitudes, as was first noticed by Griesbach and Martius. This is true of flowers, many of which, white in Southern climates, become violet in the far North.

Personified Plants. — Plants are thus personified by the *Western Christian Advocate:* The pepper and mustard represent a class known as "sharp" people; the spice-trees, others; and tobacco and barley, saloon-keepers. The violet and lily are the preachers of humility, purity, and righteousness. The tea-plant and catnip are the old ladies of the village, without whom society would be incomplete. The beet and sugar-cane are confectioners; roses and pinks, perfumers; wheat and corn, provision-dealers; and the cocoa-nut palm furnishes as many articles as a country-store. The little wayside plants by stagnant pools are scavengers. Some plants prefer water, — they are the Baptists; some run all over, — they are the Methodists; some stand up straight and orderly, — they are Presbyterians; others cling to ancient walls and churches, — they are the Episcopalians and Catholics. There are plants that live alone, like hermits; others lead a nomadic life, wandering all over every thing.

The Popular Science News.

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All NEW *subscribers remitting $1.00 before Dec. 15 will receive the last three numbers of tee present year free of charge. Dr. Nichols's book, "Whence, What, Where?" is also given as a free premium to all* NEW *subscribers at $1.00.*

☞ *Those desiring this premium should make a special request for it at the time of subscribing, or there may be delay in sending it.*

In the matter of the use of galvanized iron water-pipes or reservoirs, the *Science News* has always taken the ground that it was a practice attended with danger to health, on account of the action of water upon the zinc coating, forming soluble and poisonous salts. Certain cases have come to our own knowledge where sickness and even death have undoubtedly occurred from this cause. These views have not been very generally accepted; and the Massachusetts State Board of Health, in one of its reports (No. 5), takes the ground that the use of these pipes is unattended with danger, although it admits that zinc is acted upon by ordinary drinking-water, and that water allowed to stand in reservoirs, or drawn through pipes of zinc or galvanized iron, usually contains an appreciable amount of zinc, more or less, according to various influences. The points in favor of galvanized iron are all well brought out in an article in the current number of the *Manufacturer and Builder:* and although we have the highest respect for the opinions of its distinguished editor, we must submit that a single case of poisoning from this cause is of more value than any amount of negative evidence; and although we do not believe that its evil effects appear in every case, yet we cannot admit that galvanized iron is a perfectly safe material to be brought into contact with drinking-water or other articles of alimentation. We also notice that the Paris Council of Hygiene has prohibited the use of the metal for such purposes, for the reasons mentioned above.

The experiments of Ramsay upon the molecular formula of nitric peroxide, which has usually been written NO_2, seem to show that the true formula is N_2O_4. The method used was that suggested by Raoult, and depends upon the principle that the melting-point of glacial acetic acid is lowered by the addition of a dissolved solid or liquid, proportionally to the absolute amount of the substance dissolved, and inversely proportionally to its molecular weight. The molecular weight of several of the oxides of nitrogen is quite uncertain, owing to the anomalous results obtained by the determinations of their vapor density; and the above-mentioned experiments will be of great service in helping to solve a difficult problem.

One of the boldest engineering schemes brought forward for a long time is that proposed by Major Powell, of damming up some of the canyons of the Rocky Mountains, and converting them into immense reservoirs of water, for use in irrigating the plains below, and also serving to regulate the flow of water in the Western tributaries of the Mississippi. These immense ravines, extending far into the heart of the mountains, with their comparatively narrow mouths, offer extraordinary opportunities for accomplishing such a work at a small expense, although we think the practical value of such a system of reservoirs could only be determined by actual trial.

During the past summer the streets of this city have been in a state of constant upheaval, owing to the laying of pipes for the purpose of furnishing steam heat and power from a central station. In this system no steam is sent through the pipes; but, instead, superheated water is used at a temperature of 440° F., corresponding to a pressure of 400 pounds to the square inch. By this means much smaller pipes may be used, the water expanding into steam as soon as the pressure is reduced, either in the radiator or the cylinder of the engine. The mains are about four inches in diameter, and it is claimed that a service-pipe the size of a pencil will supply steam enough to heat a large building. The results of the accidental explosion of one of these pipes in the street are not pleasant to think of. In wet weather a column of steam ascends from the heated iron manhole covers at the street corners, giving to a stranger the impression of a miniature volcano; and the sudden bursting of one of the mains would undoubtedly reproduce the accompanying eruptive and earthquake phenomena in a most unpleasantly realistic manner.

The following strange story was related to us by the mate of a merchant-vessel, personally known by us to be a gentleman of the highest character and reliability, and may be of interest to students of psychology. While his ship was loading at Calcutta, he accepted the invitation of a native to visit his home. The native was a pedler of the lowest class, and previously unknown to the officer. On arriving at the hovel of the Hindu, he introduced his father, an emaciated old man of great age, but with piercingly brilliant eyes. After greeting the young American, in a few minutes he commanded him to look into the palm of his hand. Although at first unwilling to comply with the request, he felt himself constrained to do so, and, on looking down, saw before him in his hand a perfect vision of a room in his distant New-England home, with the different members of the family seated around a table. Although a man of iron nerves, our friend confessed that it was some time before he recovered his equanimity. We forbear to comment on this incident, only remarking that it seems better authenticated than most similar stories.

The Parisian weekly journal *La Nature*, to which we are frequently indebted for the use of its engravings, is one of the best journals of popular science published, and in the character and quality of its illustrations stands alone in its class. We are glad to make a favorable mention of our contemporary, although not solicited to do so, and can cordially recommend it to the attention of such of our readers as are somewhat familiar with the French language. The price, including postage, is $5.25 per year, or $6.00 with the Science News, and subscriptions will be received at and forwarded from this office.

[Specially reported for the *Popular Science News.*]

THE CLEVELAND MEETING OF THE AMERICAN ASSOCIATION.

The thirty-seventh meeting of the American Association for the Advancement of Science was held at Cleveland in the month of August last; and although the attendance was not quite equal to some of the previous meetings, it was an occasion of great interest and pleasure, and the majority of the papers read were of much importance and value. The sessions were held in the high-school building, which was most excellently adapted for the purpose; and the local committee, and citizens of Cleveland generally, exerted themselves most successfully for the comfort and entertainment of their visitors.

At the opening exercises the members were welcomed to Cleveland by Dr. Cady Staley of the local committee, to which President J. W. Powell replied in fitting terms. In the afternoon the different sections organized, and were addressed by their respective vice-presidents. The section of anthropology is always one of the most attractive to the general public, as was shown by the large audience which listened to Dr. C. C. Abbot's address on the antiquity of man in America. Beginning with reference to the recent decision of an ecclesiastical body, that man, perfect in all his parts, had been created *de novo* from the dust, he spoke of the greater antiquity of the men of the Pacific over those of the Atlantic coast. The actual geological age in which man first appeared is very doubtful. Miocene man is extremely problematical, and even pliocene man is a question still unsettled. We are certain, however, that man lived on the American continent in the interglacial period, and, at the time of the melting glaciers, undoubtedly followed the ice-sheet as it retreated towards the north. The actual date of the final close of the glacial period is now considered more modern than formerly. Taking the most moderate estimate of six thousand years, we must allow from eighteen thousand to sixty thousand years for the time between the first and second glacial epochs, and, in addition, the long stretch of time during which the second epoch of cold continued, thus giving the archæologist all the time he needs for the long train of human activities that have transpired during prehistoric time. Dr. Abbot described the implements of indurated argillite, or clay rock, found near Trenton, N.J., which he considered to be distinctly palæolithic in type. The fate of these palæolithic men is uncertain, but the theory that they survive in the modern Esquimaux is hardly tenable. They were undoubtedly displaced by the immigration of the modern Indian races, — themselves of great antiquity, for it is believed that the progenitors of the Indians were coeval with the mastodon, an animal which has been extinct for many hundreds if not thousands of years.

Dr. D. G. Brinton read in this section two interesting papers, in one of which he opposed the theory that the American Indians are of Asiatic origin, and another in which he supported the idea that they originated from the neolithic races of Europe, who reached this country by way of Great Britain, Iceland, and Greenland, over a tract of land since submerged beneath the sea.

In the section of chemistry, Professor C. E. Munroe reviewed the progress of the science, giving special attention to the idea of the unity of the elements, and their genesis or evolution from one primordial substance, summing up the evidence as follows :—

"Hence we find for the doctrine of evolution in the domain of chemistry that the tests yield absolute results when applied to compound matter; but the extension of the doctrine to the genesis of the elements is a pure speculation, and bids fair at present to be as incapable of absolute proof as is the nebular hypothesis."

The papers read in this section were not, as a rule, of a popular nature; but Professor W. L. Dudley gave an interesting account of the recent fatal accidents at Troy, N Y., from the breaking of the pipes conveying water-gas, which contains a large percentage of the poisonous carbonic oxide. Professor Spencer B. Newberry presented a paper upon the safety of commercial oils. He concludes that an oil which gives off explosive vapors at a temperature below 120° F. is unsafe to use in the modern forms of lamps with their large flames and increased heating power, and that the chemical composition of a safe oil is between nonane (C_9H_{20}) and decane ($C_{10}H_{22}$).

One of the most interesting papers in the section of physics was that by Professor A. A. Michelson on the use of wave-lengths of light as an absolute standard of measurement. It was illustrated by a machine devised by himself and Professor Morley for accurately measuring these magnitudes; and an apparatus was arranged so that the interference fringes, by means of which the wave-lengths are first determined, were projected on a screen by a lantern. So delicate is the adjustment, that simply breathing upon the reflectors, or holding the finger near them, is sufficient to cause the fringes to chase each other over the screen in a most lively manner.

The Panama and Nicaragua Canals were discussed in several papers, greatly to the advantage of the latter enterprise. Dr. W. Nelson, who had resided on the isthmus for several years, presented a series of photographs of the Panama Canal, showing the present condition of the work, which clearly proved that the completion of the canal is almost an impossibility. As an illustration of the neglect and waste prevailing among the contractors, he related that a valuable steam-shovel was thrown from the track by an accident, and, to save the trouble of replacing it, the contractor in charge ordered up a gravel-train, and carefully *buried* the shovel out of sight. It was not his property, and it was a useless expense to him to set it on the rails again. The numerous officials of the company have fine residences and high salaries, but do not always escape yellow fever.

Mr. W. J. Keep read a paper upon the influence of aluminium upon cast-iron, illustrated by a series of test-bars of iron containing more or less of the metal. It was shown that the addition of a fraction of one per cent of aluminium greatly improved the quality of the iron, rendering castings more solid and free from blow-holes, removing the tendency to chill, increasing the strength, elasticity, and fluidity of the iron, and decreasing the amount of shrinkage. The practical value of this discovery is undoubtedly very great.

The evening meetings were held in the large hall of the building, and were well attended, both by members and the public. Professor S. P. Langley, the retiring President, delivered an address upon the history of the undulatory theory of radiant energy, including light and heat, and a review of the causes which led to its displacement of the emission or corpuscular theory of the earlier philosophers. Professor G. Stanley Hall lectured upon recent advances in psychology, and gave many facts of great interest regarding this comparatively new science, but, in touching upon the subject of hypnotism, failed to give more than a review of the very doubtful results obtained by the French scientists. A reliable and scientific investigation of the alleged phenomena of hypnotism is greatly to be desired. An eloquent address by Major Powell upon the principle of competition as a factor in human progress, and a lecture by Professor Mendenhall upon Japanese magic mirrors, most pleasantly occupied two other evenings during the meeting.

For the numerous social entertainments of the meeting the members are greatly indebted to the citizens of Cleveland. Several receptions were given by the ladies of the city, and some of the most elegant residences on the magnificent Euclid Avenue were thrown open to them. In addition a bountiful luncheon was provided at the high-school building each day of the session, so that the members were saved the necessity of a hot two miles' ride to the centre of the city.

A steamboat excursion on Lake Erie to Put-in-Bay was also tendered the Association, and was a most delightful and successful one. The day was perfect, and the water calm. A short stop was made at Kelly's Island, to give an opportunity of inspecting the wonderful glacial scratches which have been found upon a ledge of limestone. These scratches are perhaps the finest in the world. The surface of the rock is traversed by great grooves a foot or more in depth and from two to three feet in width. There are also innumerable smaller grooves and scratches, and in places the rock is polished till it shines like marble. Nothing can give one so realizing a sense of the power of a glacier as a sight of these markings made by the prehistoric ice-sheet as it moved over the rock, holding in its grasp smaller and harder stones, which, like an immense plane, grooved the deep channels into the softer limestone.

The principal industry of Put-in-Bay is the manufacture and sale of Catawba wine, and the members of the chemistry section introduced a method of testing known as "gustatory analysis," which was quickly learned and applied by even the least scientific persons present. The results of the analyses were uniformly favorable.

The reports of the officers showed that the Association was in a most satisfactory condition, both financially and otherwise. Nearly one hundred and fifty new members were elected; and the Association adjourned, to meet next year at Toronto, with the feeling that they had participated in one of its most enjoyable and successful meetings, and with a high appreciation of the beauty of the city of Cleveland and the hospitality and generosity of its citizens.

PERFECT REST. — *Robinson:* Are you off for a trip, Brown?"

Brown: "Yes, I'm going to take a four-weeks' run over to London, Paris, and some of the German capitals."

Robinson: "Business?"

Brown: "No, health. My physician says my system is all run down, and that I need absolute rest."

[Specially reported for the *Popular Science News.*]

METEOROLOGY FOR AUGUST, 1888, WITH REVIEW OF THE SUMMER.

TEMPERATURE.

AVERAGE THERMOMETER.		Lowest.	Highest.	Range.
At 7 A.M.	65.68°	56°	80°	24°
At 2 P.M.	76.10°	66°	86°	21°
At 9 P.M.	67.06°	55°	79°	24°
Whole month	69.61°	55°	86°	31°
Last eighteen Augusts	69.07°	65.83°, in 1874.	71.76°, in 1872.	5.93°
Summer of 1888	69.11°	54°	93°	39°
Last eighteen summers	69.12°	67.19°, in 1881.	71.67°, in 1876.	4.48°

The 28th was the coolest day of the last month, with a mean of 58⅓°; and the 5th was the warmest, averaging 80¼°. The 16th, 17th, and 9th were warm, varying from 76° to 78⅓°; and the whole month was a full half-degree above the average for the last eighteen Augusts, nearly two-thirds of a degree warmer than the last July, and five-sixths of a degree warmer than June. These three summer months have thus varied only a fraction of a degree from each other, giving an average of 69.11°; August being the warmest of the three. The entire summer was nearly an exact average of the last eighteen; that in 1881 being the coolest, and that in 1876 the warmest, — a range of 4.48° (see the table).

SKY.

The face of the sky in 93 observations gave 49 fair, 20 cloudy, 19 overcast, and 5 rainy, — a percentage of 52 7 fair. The average fair for the last eighteen Augusts has been 62.7, with extremes of 50.5, in 1884 and 1885, and 86, in 1876. Only two Augusts have been less fair than the present. The last week or ten days of the month furnished some very fine weather, with beautiful sunsets on the 18th, 20th, and 22d.

The average percent fair the past summer was 54 3, while the average for the last eighteen summers has been 61.55, with extremes of 50, in 1887, and 71.4, in 1876. The present summer was the least fair, with two exceptions (in 1877 and 1887), in eighteen years.

PRECIPITATION.

The amount of rainfall the last month was 6.68 inches, while the average for the last twenty Augusts has been 4 06, with extremes of only .48 in 1883, and 10 03, in 1872. The amount of the present month has been exceeded in August but four times in twenty years. The largest fall at one time, 3.35 inches, came suddenly during the night of the 21st, attended with strong wind, doing some damage. Over one inch fell on the 6th, and again on the 13th, with smaller quantities on three or four other occasions, giving an abundance for vegetation. The amount since Jan. 1 has been 36.39 inches, while the average for this period has been only 31.67; showing an excess thus far of 4 72 inches.

The amount of rain the present summer has been 9.59 inches, while the average for the last twenty summers has been 9.79, with remarkable extremes of only 4.39 inches, in 1883, and 18.13, in 1872, — a wide difference for these important growing months.

PRESSURE.

The average pressure the past month was 29 934 inches, with extremes of 29.52, on the 22d, and 30.20, on the 11th and 12th, — a range of .68 inch. The average for the last fifteen Augusts has been 29.960, with extremes of 29 868, in 1878, and 30 029, in 1884. The sum of daily variations was 2.60 inches, giving an average daily

movement of .084 inch. This average in fifteen Augusts has been .087, with extremes of .051 and .125. The largest daily movements were .56, on the 2d, and .34, on the 13th, in connection with heavy rainfalls. However, on the 6th was a rain fall of 1.18 inches, when the movement was upward .10 inch, showing that we may have rain occasionally not indicated by the barometer. On the 5th the movement was —.02 only, and stationary on the 7th.

The average pressure during the past summer was 29.934 inches, exactly the same as the present August, which is very near 29.938, the average of the last fifteen summers. The average daily movement the last summer has been .105 inch, while that of the last fifteen summers has been only .099.

WINDS.

The direction of the wind in 93 observations gave 8 N , 1 S., 7 E., 35 W., 4 N.E., 19 N.W., 2 S.E., and 17 S.W , — an excess of 11 northerly and 58 westerly over the southerly and easterly, and indicating the average direction to have been W. 10° 44′ N. The westerly winds have uniformly prevailed over the easterly, with two exceptions, by an average of 33 42 observations, and the southerly over the northerly, with four exceptions, by an average of 10.68 ; indicating the approximate general average of the wind the last nineteen Augusts to have been W. 17° 44′ S., which shows that the winds the past month have been 28° 28′ more northerly than the average. The relative progressive distance travelled the past month was 59.03 units, and during the last nineteen Augusts 666.7 such units, — an average of 35.09; showing less opposing winds the past month than usual, in proportion of 59 to 35.

The average direction of the wind the present summer has been W. 8° 21′ N., while the average direction for the last nineteen summers has been W. 28° 56′ S., showing that the wind the present summer has been 37° 17′ more northerly than usual. The average relative distance travelled the present summer was 48.22 units, and the last nineteen summers 736.3 such units, — an average of 38 75; showing less opposing winds the present summer than usual, in proportion of 48 to 38 nearly.

REVIEW.

The present summer has been a near average in regard to temperature, rainfall, and barometric pressure, but with winds much more northerly and less opposing than usual, and the least fair, with two exceptions, in eighteen years. The southerly winds prevail almost universally during the three summer months; but this year the reverse has occurred, the only instance on my record.

D. W.

Natick, *Sept.* 5, 1888.

[Specially computed for the *Popular Science News.*]

ASTRONOMICAL PHENOMENA FOR OCTOBER, 1888.

The Planets. — Mercury comes to its greatest eastern elongation on Oct 8, and may possibly be seen as an evening star during the first few days of the month ; but it is far south of the Sun, and will be hard to see. On Oct 9 it is in conjunction with Venus, 3° to the south of the latter. It comes to inferior conjunction on Oct. 31. Venus is an evening star, gradually moving away from the Sun. By the end of the month it remains above the horizon a little less than two hours after sunset. Mars sets still earlier than during September. At the beginning of the month it sets at a little after 9 P.M , and at the end of the month at about 8*h.* 30*m.* P.M. It is moving eastward through the constellations Scorpius and Sagittarius. Jupiter sets before nine o'clock on Oct. 1, and at about seven o'clock on Oct. 31. It is in the constellation Scorpius, and moves eastward about 6° during the month. Toward the close of the month it is about 5° north of the first-magnitude red star Antares (*Alpha* Scorpii). The following eclipses of Jupiter's satellites will be visible in the United States during the month. They all take place on the upper right-hand quadrant, as seen in an inverting telescope. D denotes disappearance, R reappearance. Times are Eastern standard.

I. R. Oct. 1, 11h. 15m. P.M.	III. D. Oct. 25, 5h. 54m. P.M.
I. R. Oct. 10, 7h. 39m. P.M.	III. R. Oct. 25, 7h. 57m. P.M.
II. R. Oct. 12, 8h. 2m. P.M.	I. R. Oct. 26, 5h. 57m. P.M.
I. R. Oct. 17, 9h. 33m. P.M.	

Saturn rises at about 2 A.M. on Oct. 1, and at about midnight on Oct. 31. It is in the western part of the constellation Leo, and is moving slowly eastward; at the end of the month it is about 8° west of the first-magnitude star Regulus (*Alpha* Leonis). Uranus is too near the Sun to be seen during the month. It is in conjunction on Oct. 11, and becomes a morning star. Neptune is about 5° south of the Pleiades.

The Constellations. — The positions given hold good for latitudes differing not many degrees from 40° north, and for 10, 9, and 8 P.M. for the beginning, middle, and end of the month respectively.

The small constellation Lacerta is in the zenith. Pegasus is just below it to the south on both sides of the meridian. Aquarius is on the south meridian, about halfway up; and below it is Piscis Australis. Cetus is low down in the south-east. Pisces follows Aquarius, and is just below Pegasus. Andromeda is high up, a little north of east; and below it are Aries, a little to the right, and Taurus, lower down, a little to the left. Perseus is about halfway up in the north-east, and Auriga is below it. Cassiopeia is coming to the meridian between the zenith and the pole; and Ursa Major is on the north horizon, with the pointers on the meridian below the pole. Ursa Minor is mainly to the left of the pole star and a little below, and Draco is to the left of Ursa Minor. Cygnus is to the west of the zenith.

M.

Lake Forest, Ill., *Sept.* 20.

Fine Threads of Quartz. — C. V. Boys gives an account of some very interesting experiments in the production of the finest threads of glass and other materials. The most remarkable threads he has found are those of quartz. Of these he says, "As torsion threads, these fibres of quartz would seem to be more perfect in their elasticity than any known; they are as strong as steel, and can be made of any reasonable length, perfectly uniform in diameter, and, as already explained, exceedingly fine (i.e., 'beyond the power of any possible microscope'). The tail ends of those that become invisible must have a moment of torsion of 100-000,000 times less than ordinary spun glass; and, though it is impossible to manipulate with those, there is no difficulty with threads less than one ten-thousandth of an inch in diameter."

QUESTIONS AND ANSWERS.

Letters of inquiry should enclose a two-cent stamp, as well as the name and address of the writer, which will not be published.

Questions regarding the treatmeut of diseases cannot be answered in this columu.

N. T. V., *California.* — What gives to indelible ink its peculiar properties?

Answer. — The indelible inks commonly used are a preparatiou of nitrate of silver. When cloth is marked with this, and exposed to the light aud air, the nitrate of silver is reduced to metallic silver, which is insoluble iu water and the other cleausing materials used in the laundry.

I. T. K., *Mississippi.* — If the action of the force of gravity should be universally suspended at any given moment, what would be the effect upon the motions of the stars and planets?

Answer. — The attraction of gravitation is an inherent property of matter, and we can hardly conceive of its being "suspended." In such a case, however, all bodies moving in circular or elliptical orbits would move off in straight lines tangent to that part of the orbit where they were at the time, and, so far as we know, would continue to move on indefinitely at the same speed.

T. A. O., *Germany.* — Is the power exerted by a hydraulic press dependent in any way upon the liquid used in it?

Answer. — Liquids are practically incompressible, and only serve to *transmit* the power. The only reason for substituting oil, glycerine, or alcohol in certain cases is either to avoid evaporation or to prevent freezing when the apparatus is exposed to low temperatures.

F. P. T., *Buffalo.* — In what form of ore does tin occur?

Answer. — The principal ore of tin is the oxide (SuO_2) known as cassiterite, or tin-stone. The principal mines are in England and the East Indies, although it occurs in several other localities. It is reduced by smelting with coal, but the ore and metal must be purified by rather complicated processes.

Inquirer. — What is the magnetic oxide of iron?

Answer. — This is a compound of a molecule of ferrous oxide, FeO, with one of ferric oxide, Fe_2O_3, thus giving it the empirical symbol Fe_3O_4. It is the only oxide of iron that is attracted by the magnet, and occurs abundantly in nature as the mineral magnitite. It sometimes exhibits magnetic polarity, and is then called a loadstone, or natural magnet. It is doubtful whether it is an independent oxide of iron or a simple mixture of the two oxides named above.

I. G. E., *Boston.* — There is no difference in composition between potash aud pearlash. Both are more or less impure carbonates of potassium, the pearlash being the purest.

R. B. P , *Jacksonville.* — What is the actual total force exerted by gunpowder at the moment of its explosion?

Answer. — It has been found by experiment that one volume of powder gives, on ignition, 280 volumes of gas at 32° F. At the temperature produced by the explosion this would be expanded to 3,640 volumes, which, if confined within the space originally occupied by the guupowder, would exert a pressure of about thirty-six tons per square inch.

Artist, *Brooklyn.* — The color known as ultramarine was formerly the powder of the precious mineral lapis-lazuli, which is essentially a silicate of alumina with varying quantities of soda, sulphuric acid, and sulphur. It was, and is now to some extent, used as a pigment by artists; but for most purposes the artificial ultramarine is used, which is made in immense quanties and at a very low cost. It is prepared by heating together a mixture of clay, carbonate of soda, sulphur, and charcoal, and afterwards roasting repeatedly with additional quantities of sulphur. The formula $2(Na_2Al_2Si_2O_8) \cdot N_2S_2$ has been assigned to it, but the actual composition is uucertain.

LITERARY NOTES.

The baby is ruler of the household: and, as is befitting, *Babyland* is the official organ of the baby's kingdom. It is a charming little monthly of eight pages, filled with pictures to please baby's eye, and little jingles and stories to please his ear. It is a marvel of enjoyment, for 50 cents a year, or $1.40 with *Popular Science News.* D. Lothrop Company, Boston, will send a sample for five cents.

Light, Heat, and Power is published at Philadelphia in the interest of the gas industries. It has recently changed from a monthly to a weekly, and will doubtless hold even a more prominent place than before in the ranks of industrial journalism.

The receipt of the following pamphlets, etc., is acknowledged with thanks: *Heredity*, by Dr. J. T. Searcy, Tuscaloosa, Ala.; *The Traditional Errors of Surgery*, by Dr. R. J. Levis of Philadelphia; *Social Ethics*, by Dr. William M. McLaury of New York; *History and Work of the Warner Observatory* at Rochester, N.Y.; *Dependent Children*, by C. H. Reeve of Plymouth, Ind.; *Report of the Rhode Island State Board of Health*; *Bulletin of the Massachusetts Agricultural Experiment-Station*; and *Report of the Division of Forestry of the United States Department of Agriculture.*

Medicine and Pharmacy.

THE AMENITIES OF THE DOCTOR'S LIFE.

The life of a physician in active practice is a hard one at the best. There is no time that he can call his own. His morning meal is interrupted by a call to some case of sudden illness; and, after a day of exhausting labor, he may be awakened just as he has fallen asleep, and obliged to spend the remainder of the night with some suffering patient who fails both to appreciate the value of his services or the necessity for the payment of his well-earned fee.

The constant association with scenes of sorrow, suffering, and death is wearying and disheartening in the highest degree. The physician sees, in the sick-room, human nature as it really is, devoid of all mask or concealment; and it is safe to say that those cases are few in which the true nature is not greatly inferior to that usually presented to the world. If his patient succumbs to the disease, the doctor is too often unjustly blamed; while if he recovers, he finds that appreciation and gratitude are developed in inverse proportion to the progress of convalescence.

"Three faces hath the doctor: when first sought,
An angel's; then a god's, the cure half wrought;
But when, complete, he comes to seek his fee,
The Devil's then less terrible than he."

Notwithstanding all these drawbacks, the life of a successful and skilful physician is a most satisfying one to those who really love their profession, and none other should enter it. No calling is more noble or more useful. There is a satisfaction and delight in relieving pain, and restoring health and strength, which the physician experiences in all its fulness, even when the patient himself is unappreciative. The practice of medicine furnishes a wide field for the exercise of the scientific faculty, whether it be in the direction of the manipulative dexterity of practical surgery or the more purely intellectual work of the treatment of functional and organic disease. A large proportion of those most eminent in natural and physical science have been men who began their career as students of medicine, and only at a later period of their life abandoned the hospital and dissecting-room for the chemist's laboratory or the naturalist's study.

The social position of the physician is in this country a remarkably high one. In other countries, notably in England, the case is different. He is there considered as rather belonging to a lower class of society, and only worthy to be ranked with tradesmen. A prominent London physician once remarked to us, that some of his noble patients would refuse to recognize him upon the street, not considering him worthy of the honor of their acquaintance, except in a purely "professional" way. With us, however, the case is very different. The physician is usually a prominent man in the community, and the trusted friend and counsellor of families and individuals, in many cases for generations. It has been said, and we think truly, that in New England the family physician now fills the place formerly occupied by the minister as a family friend and confidant. From a more practical point of view it may be remarked that a man of average sense and skill is usually certain of obtaining at least a comfortable living in the practice of his profession, although the instances where physicians have amassed great wealth are few and far between.

It is in the consciousness of his power and usefulness, however, that the physician experiences his highest satisfaction. From the hour of birth to that of death he watches over his fellow-beings, relieves their pain, and preserves and prolongs their existence. Fortunate is he who has for his medical adviser a wise, skilful, and conscientious man, such as is so often found in the profession; and happy is such a physician in the consciousness of a useful, honorable, and noble life.

[Original in *Popular Science News.*]

OTITIS.

During the summer season of the year, when multitudes are plunging into the surf and rolling in the sand at the seashore, earaches are quite common, and unrelenting pain is suffered for many long hours by those whose tender aural membranes are unable to withstand the excessive irritation of the sand, and the acrid, gritty waves, which dash, not only into the ears, but into the eyes, the mouth, and the nose as well. It is now fully recognized that cold bathing, either in fresh or salt water, as indulged in so freely in the open air during the summer months, involves some danger to the ears. Upon prolonged swimming, with an occasional ducking of the head, inflammation may ensue from the entrance of the water through the auditory canal to the membrana tympani, and, if this be perforated, from its lodgement in the tympanum; while in those who dive head foremost, or strangle from any cause, inflammation is likely to be caused by the passage of water through the nares into the Eustachian tube and the middle ear. The presence of sand or of any other foreign substance in the external meatus is a common cause of aural inflammation, while it is not unfrequently induced by prolonged cold-water bathing in a bath-tub, or from allowing a stream of cold water to pour upon the head. Most bathers are unmindful of the liability to injury to which their ears are injudiciously exposed; and while it is admitted that many of them escape injury of their ears, it is also probable, on account of the numerous other causes of aural inflammation than those already mentioned, that when induced, the malady is likely to be explained in some other way.

Whether it is caused by an accumulation of cerumen, or excited by currents of cold air or irritation of decayed teeth, whether it be attendant upon fever or other debilitating disease, or due to any of the causes previously mentioned, or any cause whatever, otitis is an exceedingly painful, and may prove a very serious, malady. Ulceration may ensue, and destroy the membrana tympani, and even the ossicula, causing deafness; while the inflammation may extend from the internal ear to the membranes of the brain. The necessity of careful examination and careful treatment is at once obvious. The inflamed part swells; and, although the swelling is slow, it often causes complete occlusion of the meatus, and affects the parts around the ear, which are always exquisitely tender, and intolerant of the slightest pressure. When the disease is at its height, the sufferer is unable to masticate, or to lie on the affected side. There is generally more or less fever, and sometimes delirium. In giving the treatment of this malady, the writer has not only the benefit of having treated numerous cases, but of having experienced the unpleasant symptoms of the affection in their severity, — the result of bathing in salt water with the ears unprotected.

The most rational plan of treatment would be to protect the external ear when about to take a cold bath, for indeed, in such a circumstance, "an ounce of prevention is worth a pound of cure" If cotton or wool stuck into the meatus can be made to answer the purpose, it will be all that can be required; but in all probability it will be washed out, consequently the best way is to tie protecting pads or plugs over the external ear. A very efficient protection is gained by tying an ear-muff made of oiled silk over the entire auricle. But when the drum membrane is perforated, not a drop of cold water should enter the external ear, since its admission into the tympanum is sufficient to rekindle the old inflammation with redoubled vigor. Consequently I know of no protection that will render surf-bathing perfectly safe for any one who has had an aural disease, especially if that disease has left a perforation of the membrana tympani. Moreover, in such cases the head should be screened from any cold or current of air, and should be covered at night, and a pledget of cotton or wool applied in the meatus.

When inflammation of the ear does result from bathing or any other cause, the first step is to cleanse the ear by gentle syringing with warm water. This will remove any sand or other substance which may have collected in the meatus, and open the way to a speedy recovery. The water used should be neither hot nor cold, as both of these extremes are to be avoided, and should be free from all substances that might irritate the inflamed parts. This irrigation, which is to be repeated at least three times a day, is best effected by the aural douche. When this is not at hand, the family syringe makes a good substitute, and is to be converted into a siphon. To accomplish this, the syringe is filled by compressing the bulb a few times, and the vessel containing the water is raised a short distance above the patient's head, when, by lowering the nozzle, the water will flow in a gentle stream, which is to be turned on the inflamed parts. An ear-spout should be fastened under the ear, down which the water returning from the ear may run into a vessel provided to receive it. An ear-syringe is not entirely objectionable, but it must be used with care.

The patient should be cautioned against introducing any thing into the ear, as the temptation to do so will be great on account of the pain and itching occasioned by the inflammation. The application of oils and fats is unnecessary, and, when put into the ear, generally prove a source of irritation and disease, on account of their liability to become rancid. If the pain is severe, a pledget of cotton dipped in a solution of atropine, — forty grains to the ounce, — and placed in the meatus, will generally afford immediate relief, while tobacco-smoke blown into the ear through the stem of a pipe, or ether injected by means of an atomizer, will often prove very effective. When there is great heat and tenderness, or if the auditory canal be completely closed, a leech or two below the meatus, or a small portion of blistering paper worn over the mastoid process for a short time, will generally subdue the immediate symptoms.

If necessary, the bowels should be regulated by some mild cathartic, — an occasional Seidlitz pow-

der answering very well, — and the diet should be restricted to liquids, which, on account of the pain caused by mastication, will probably be the only food that the patient desires. Aperient and cooling medicines, and morphia in full doses to procure sleep, may be administered. Under such treatment the severity of the pain generally diminishes in a few days, and the disease may terminate in resolution. It may, however, terminate in a discharge through the Eustachian tube or the membrana tympani; but, as space will not permit the discussion of chronic otitis in this article, the special treatment of these cases must be deferred until some future time.

J. H. E.

[Specially compiled for the *Popular Science News.*]

MONTHLY SUMMARY OF MEDICAL PROGRESS.

BY W. S. WELLS, M.D.

At the recent meeting of the French Association for the Advancement of Science (*l'Union Méd.*) M. Gillot communicated an article regarding the tongue as a guide to the diagnosis of lesions of the intra-cranial blood-vessels.

In the ordinary examinations of the tongue only the upper surface is usually inspected, and the under surface is seldom noticed.

Dr. Gillot refers to this neglect, and asserts that the under surface may present certain points of diagnostic significance.

In a young and healthy person the veins alone are prominent beneath the mucous membrane; but with the advance of age, or as a result of disease, these veins become dilated, tortuous, or varicose, and the venules and capillaries become visible. In many cases little dilatations, like grains of sand, may be seen on the smaller vessels, and may be few and dissemiuated, or numerous and grouped together. They are usually situated a short distance from the tip of the tongue, on either side of the median line, or near the root of the organ.

Their color varies, according to their size and the condition of the general circulation, from a bright red to purple or almost black.

These projections, as claimed by Dr. Gillot, are true miliary aneurisms, caused by a thinning of the walls of the vessels, and are analogous to the aneurisms occurring on the blood-vessels of the brain. He believes that the existence of these dilatations of the blood-vessels of the under surface of the tongue is diagnostic of a similar condition of the blood-vessels of the brain. The circulation of the tongue has very close relations with that within the cranium, — the same influences which act upon the one, acting also upon the other, — and the inspection of the under surface of the tongue furnishes as valuable an indication of the state of the cerebral circulation as does the examination of the cavity of the eye by the ophthalmoscope.

Dr. Gillot refers the primary cause of these miliary aneurisms of both the tongue and the brain to the so-called arthritic diathesis, and says he has never seen these dilatations in any but those suffering from gout, rheumatism, gravel, and heart diseases of arthritic origin. He therefore urges in the aged, and those presenting rheumatic and gouty symptoms, a careful inspection of the under surface of the tongue, as likely to assist materially in averting, by proper treatment, grave cerebral disorders.

M. Schwartz lately read to the Surgical Society of Paris a communication on a case of pressure paralysis from a callus, reported by M. Marchand. A man aged twenty-nine had been thrown from a horse, sustaining a fracture of the upper end of the fibula, with posterior luxation of the tibia. A plaster-of-Paris splint was applied; but when it was removed, at the end of six weeks, the patient was found to be suffering from various disturbances of sensibility and motion.

The foot was in an equinos position, and anæsthesia and paralysis existed in the parts supplied by the external popliteal nerve. The electrical contractility was abolished, and a marked degree of atrophy existed.

There was considerable callus at the seat of the fracture of the fibula, and pressure here caused pain. Thinking that the nerve might be imprisoned in the callus, M. Marchand laid bare the tumor, and discovered the external popliteal nerve passing over it. On following up the trunk of the nerve, it was found to be embedded in a mass of hard fibroid tissue.

When freed from this, the nerve was found enlarged at this part, and congested.

The wound healed readily, but it was only gradually that motion and sensation returned; and it was remarked as singular that the power of voluntary movement was gained before the restoration of electrical contractility. At the end of seven months the patient's condition was nearly normal.

M. Marchand referred to the rarity of this accident, but called attention especially to the exceptionally good results following the release of the imprisoned nerve. In some of the cases previously reported, slight or no improvement was obtained by operation, and in others inflammation of the nerve occurred, necessitating amputation.

Another case is published (*International Jour. Surg.*) of preservation of severed digits, this one being remarkable for the length of time which elapsed from the time of the accident until the adjustment of the part.

A boy while splitting wood cut off a part of his right thumb. It dropped to the ground, and he ran into the house. The mother hunted up the father, who went to the barn, harnessed the horse, found the severed piece of thumb, wrapped it with the stump in a cloth, and drove nearly three miles to the doctor. Fully an hour and a half elapsed before the doctor saw him, when he removed the cloth, and found the thumb lying loosely in the bandage, and covered with sand and dirt. The doctor cleansed it and secured it to the stump. It united promptly, and two years afterwards it was hard to tell which thumb had been injured.

Dr. W. J. Clapp (*London Lancet*) reports a case of tetanus successfully treated with strophanthus The patient was a man aged twenty-three. Three weeks previously he had an accident by which the nail of the little finger of his left hand was torn, from which he suffered severe pain; followed, in time, by burning pains between the shoulders, extending down the spine. Subsequently followed rigidity of the abdominal muscles, spasms of body, chest, arms, thighs, and legs. The jaws became locked, countenance anxious, face and mouth contracted, pulse quick and wiry, temperature 108° F. The urine was dark and scanty, without deposit; bowels constipated.

Various remedies were with difficulty given, without improvement; and it was determined to give strophanthus a trial. Dr. Clapp employed tabloids containing two minims each. One was given every three hours, it being with difficulty placed in his mouth, and cold water, also, after each tabloid. The second day after this treatment with strophanthus a decided improvement was noted. The doctor could open the patient's mouth sufficiently to introduce the mouth of a feeding-cup. The spasms in all the affected parts became less frequent, the pulse quiet, and the temperature lower. Nourishment was increased. The frequency of the doses of strophanthus was gradually lowered. The urine became copious and clear, all the symptoms abated, and in a fortnight the man was able to walk and take food as usual.

Burns being so common an accident, and often so difficult to treat, the following formula is recommended by an exchange : —

℞. Tannin	. . . . .	4 grams.
Alcohol (95°)	. . . . .	4 "
Ether sulph. rectf.	. . . . .	30 "

M. Paint the parts with this two or three times a day.

After evaporation of the ether, there remains a fine pellicle of tannin over the burn, which excludes the air, and takes away the pain and inflammation, and the cure is much more rapid than with the various collodion preparations. The first painting of the parts should always be preceded by a careful antiseptic washing, to remove foreign substances that may have adhered, and all blisters should be punctured before applying the remedy.

If some time has passed before treatment, a slight coating of iodoform should be powdered over the part first.

THE DIAGNOSIS OF HUMAN BLOOD.

Dr. Henry Formad contributes an elaborate article upon the comparative morphology of the blood-cells to our always interesting contemporary, *The Journal of Comparative Medicine.* Dr. Formad's studies have not led him to any especially new results, but they confirm views previously expressed as regards the size and appearances of the blood-cells, and some useful directions are given for examining blood-stains and measuring the corpuscular elements. It is a tribute to the accuracy of Gulliver's original measurements that Formad adopts the figure $\frac{1}{3200}$ inch as the average diameter of the red corpuscle. Our author also supports the claims of the late Dr. J. G. Richardson in regard to the value of very high powers in the measurement of the blood-cells.

For testing the question whether a certain substance is blood or not, the spectroscope and chemical reagents come into play; but for the recognition of human blood the microscope alone is of any value, and the sole method yet found available with this instrument is that of measurement of the corpuscular elements. The differentiation of mammalian blood from that of lower orders of animals is made easy by the fact that in mammals alone is the cell round and non-nucleated. The differentiation between the blood of man and that of lower mammals depends entirely upon the micrometer.

Only the following animals have corpuscles larger than man, i. e., larger than $\frac{1}{3200}$ of an inch; viz., the elephant, great ant-eater, walrus, sloth, platypus, whale, capibara, and (according to Wormley) opossum. Animals the corpuscles of which are slightly below man in size, i.e., having corpuscles from $\frac{1}{3500}$ to $\frac{1}{3200}$ of an inch average diameter, are the seal, beaver, musk-rat, porcupine, monkey, kangaroo, wolf, and guinea-pig. None of these are domestic animals. All other animals, including all domestic animals, have blood-corpuscles of a mean diameter less than $\frac{1}{3500}$ of an inch; and, in fact, those animals which, as a rule, are blamed for blood-stains found on the clothing and apparel of criminals (ox, pig, horse, sheep, and goat) have corpuscles with an average diameter less than $\frac{1}{4000}$ of an inch.

The above facts are formulated as follows : —

1. The blood-corpuscles of birds, fishes, and reptiles, being oval and nucleated, can never be mistaken for human blood.

2. Fresh human blood cannot be mistaken, under

the microscope, for the blood of any animal the corpuscles of which have a mean diameter of less than $\frac{1}{4000}$ or even $\frac{1}{3600}$ of an inch.

3. (*a*) If the average diameter of blood-corpuscles in fresh blood is less than $\frac{1}{4000}$, then it cannot possibly be human blood.

(*b*) If the diameter is more than $\frac{1}{3500}$, then it may be human blood.

(*c*) If the blood-corpuscles, after exhaustive measurement, give a mean diameter of more than $\frac{1}{3500}$, then it *is* human blood (provided it is not the blood of one of the wild beasts referred to).

The foregoing applies especially to the diagnosis of fresh blood. With regard to dried blood, it is claimed that this can be recognized just as readily, provided it has dried quickly. Blood that has dried slowly, undergoes decomposition, and its morphology cannot be made out. A good liquid for remoistening blood is Müller's fluid; but perhaps the best is Virchow's solution, composed of thirty parts caustic potash and seventy parts water. At least five hundred measurements should be made in order to establish the average diameter of the cells.

If the corpuscles are spheroidal from absorption of moisture, or crenated from drying, they may still be diagnosed, because such changes, as seen from the tables, are the same in the corpuscles of all animals, and have really their proportionate and corresponding ratio of alteration in form and diminution in size, the range or scale of diminution being always alike in the same animal. —

The red blood-corpuscles that have become spherical from imbibition of liquid have thus presented in Dr. Formad's experiments the following average diameters in the various animals: —

1.	Man, $\frac{1}{3300}$ in.	5.	Rabbit, $\frac{1}{4000}$ in.
2.	Guinea-pig, $\frac{1}{3500}$ in.	6.	Ox, $\frac{1}{5000}$ in.
3.	Wolf, $\frac{1}{4000}$ in.	7.	Sheep, $\frac{1}{5000}$ in.
4.	Dog, $\frac{1}{3000}$ in.	8.	Goat, $\frac{1}{5100}$ in.

These figures show that the diameter of the artificially spherical corpuscles in each animal is just about one-third less than that of the normal biconcave or disk-like corpuscles of the same animals.

Dr. Formad is very positive about the value of the microscope and micrometer in determining human blood, taking much the same position as that of Dr. Richardson. Fortunately it is not very often that the microscope is called upon to decide whether a certain stain is that of human blood or of the blood of a domestic mammal. We hardly think that a jury would convict on its testimony that the corpuscles in a clot were $\frac{1}{5000}$ inch too broad to be those of a dog or guinea-pig. Still, the opinious of experts are becoming more fixed upon this matter, and doubtless Dr. Formad's article will help to give certainty to a hitherto mooted point. — *Medical Record.*

MEDICAL MEMORANDA.

The Percentage of Positively Useful Drugs. — Dr. Uhler writes in the *Maryland Medical Journal*, "Materia medica and therapeutics are more exact than I anticipated; for, after an examination of 324 remedies described in our textbooks, I find that 218 are kuown to frequently do their work, 116 are uutrustworthy, and about one-third of the whole, or 108, are very active: and this is probably the correct answer to Professor Bartholow's question of the 'Degree of Certainty in Therapeutics.'"

Hospital Telephones. — There is a talk of applying telephones to the infectious wards of the French hospitals, so as to enable the sick people isolated in their contagious sufferings to have the comfort of hearing their relatives' voices without any risk of conveying infection by an interview. It certainly is a very humane idea, and would not — one would think — be a very costly one to carry out.

"Recommended by all Physicians." — An English antiquarian has been delving among old newspaper files, and has discovered what he says is the first commercial advertisement ever printed in a newspaper. It appeared in the *Mercurius Politicus* of London, dated Sept. 30, 1658. It runs as follows: "That Excellent and by all Physitians approved China Drink called by all the Chineans Tcha, by other nations Tay alias Tee, is sold at the Sultaness Head Cophee House, in Sweeting's Rents, by the Royal Exchange, London."

Bone-Cutting by Electricity. — Removal of sections of bone in surgical operations has heretofore been a long, tedious process, effected with a mallet, chisel, gouges, etc. It is, perhaps, the most brutal and unscientific method which could be adopted, and sounds like the opcrative butchery which existed in the last century. This has all been reformed by an invention called the electric osteotome, says the London *Electrical Engineer*, which is an instrument holding a circular saw at its extremity, revolved with lightning speed by an electric motor. This, when held against a bone, makes a clean cut through it in a few seconds; in fact, its action is instantaneous. By holding the osteotome in a slanting position, wedge-shaped pieces can be cut out with equal promptitude. There is no danger of the saw cutting the soft parts, as they are protected by a retractor, — an instrument which is passed down and under the bone.

Treatment of Pneumonia. — In the good old days when the accumulation of a winter's *debris* in the blood was drawn off by way of the mediobasilic vein, when pneumonia patients were placed in a sitting posture and bled till they fell over, the mortality rate in this disease was something over one in three. When phlebotomy was changed for emetics and purgatives, only about one in four succumbed. Later the "do-nothing plan" reduced the mortality to about fifteen per cent; and, followiug this, the supportive treatment has reduced the death rate in uncomplicated cases to less than five per cent.

HUMORS.

The Deadly Milk-Shake. — A writer in the *Medical Review* humorously remarks, "The average overheated child or adult who runs the gantlet of corner dairies, soda stands, and their accompaniments of flies, germs, tyrotoxicon, etc., and partakes of a large glass of cold milk the only merit of which is, that it has been violently agitated with broken ice, is likely to become violently agitated himself, with broken hopes, cramp-colic, and intestinal indigestions."

A Spanish Magistrate, shocked and exasperated by repeated food adulteration, has issued a proclamation, aflame with righteous wrath, that "all wines, groceries, and provisions which, upon analysis, are proved to be injurious to health, will be confiscated forthwith, and distributed to the different charitable institutions."

A little boy was taken sick for the first time, and the doctor with much ceremony made him swallow a powder "Papa," said the boy, a minute later, "ain't it time I was taking the *shot*, now?" — *Puck.*

A Mistake in Diagnosis. — "I find, madam," said a young physician, "that your husband is suffering from overwork." — "And will he have to give up his place under the government?" she asked anxiously. "What's that? Is he a government official?" — "Yes, sir." — "H-m! I'll diagnose his case again. He probably needs exercise."

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SPECIAL NOTICE.

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Publishers' Column.

A pen picture — Esterbrook's display of Steel Pens at the various expositions, Philadelphia, St. Louis, Louisville, New Orleans, at all of which medals were awarded.

Dr. Benjamin H. Briggs, Selma, Ala., writes, Colden's Liquid Beef Tonic is an excellent preparation, whose composition is known, and one that physicians can intelligently prescribe. I have found it of great service in my practice.

McArthur's Syrup of Hypophosphites is intended for physicians' use only, and is not in any sense a patent medicine. It has already become a standard preparation among the medical profession.

A long list of seasonable books is advertised in this number by Mr. Bradlee Whidden. All persons interested in any department of natural history will find some volume in the list which will be indispensable to them in the pursuit of their favorite study.

An immense advance has been made in breweries in the past six years by the change from ice to machine refrigeration; large gains in storage capacity, lower and more uniform temperatures under perfect control, drier and purer air in cellars, and the absence of dripping ceilings and slushy floors. The machines made by David Boyle of Chicago are extensively used, and give universal satisfaction.

Frye's Emulsion of Cod-Liver Oil is made by special machinery, and the emulsifying process is much more complete and thorough than by the old-fashioned methods. In addition, only the very best quality of oil is used, thus producing a preparation of the highest value and efficacy.

Thayer's Nutritive is a preparation which, although not claiming to be a medicine, must undoubtedly have great remedial value in diseases where the powers of assimilation of ordinary food are impaired. It possesses stimulant and nutritive properties in snch a form that little work is required from the digestive organs, which are thus given a chance to rest and regain their usual strength.

A physician writes, "In cases where mental effort has been protracted till a sense of weariness renders its continuance difficult, a dose of Horsford's Acid Phosphate, from its stimulant effect, relieves fatigue, and seems to invigorate the mental powers, and prepare the mind for renewed exertion. In the night-sweats attending consumption and other distressing diseases this preparation can be employed with marked benefit." Horsford's Acid Phosphate is very agreeable to the taste, and not nauseons. It is for sale by all druggists and dealers in medicine.

One of the most popnlar wines on the market to-day is the Florida Wine Company's Orange Wine. This wine, which is a delightful beverage for table use, and which is also prescribed in several leading hospitals both in Philadelphia and New York, is made at Clay Springs, Orange County, Florida, from the skinless pulp of the richest and ripest oranges. The wine, while having sufficient "body," is at the same time as light as champagne, and slightly aromatic. It is non-intoxicating, containing less than twelve per cent of alcohol.

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AND

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CONTENTS.

FAMILIAR SCIENCE. — Simple Scientific Experiments 159
The Megalithic Monuments of Carnac 160
The Tendency of Matter at the Surface of the Earth 160
The Origin of the Sneezing Formula 161
How a Mound was Built 162
Scientific Brevities 162

PRACTICAL CHEMISTRY AND THE ARTS. — Soap 163
Fast Time on American Railroads 163
Filtration with Filters of Metallic Felt 164
How Celluloid is Made 164
Ballooning with Natural Gas 164
Practical Receipes 164
Industrial Memoranda 164

HOME, FARM, AND GARDEN. — Edible Mushrooms 165
On Pomology 165
Ancient Horticulture 166
The Fallacy of "Plain Living" 166
Selected Receipes 166

EDITORIAL. — Organic Chemistry 167
Meteorology for September, 1888 168
Astronomical Phenomena for November, 1888 169
Bowlder Rocks 169
Questions and Answers 169
Literary Notes 169

MEDICINE AND PHARMACY. — The Opium Habit 170
Monthly Summary of Medical Progress 170
Whooping Cough 171
Medical Memoranda 172

PUBLISHERS' COLUMN 172

Familiar Science.

SIMPLE SCIENTIFIC EXPERIMENTS.

THE phenomena of the surface tension of liquids are at present receiving much attention from physicists. The subject was fully described in the July number of the *Science News;* but we may say briefly that it is now believed that at the surface of every liquid there is a thin film of the same substance, which is in a state of constant tension, like an elastic membrane. A rubber toy balloon distended

FIG. 1.

with water roughly illustrates the conditions present in a drop of that liquid.

From certain investigations made by Plateau and Quincke, it is estimated that the thickness of this film is not more than $\frac{1}{5000000}$ of an inch. The tension of the film varies with different liquids; for water it is about two and three-quarters grains for every inch of length, for alcohol a little less than one grain, and for ether only about three-quarters of a grain. The following experiments, illustrated by engravings from *La Nature*, show how the existence of surface tension may be easily proved.

Take a large and a small pencil, place them together, and, with the aid of a small brush, wet the adjoining surfaces. The tension of the film of water between them, as shown at *ab*, Fig. 1, will be sufficient to hold the two firmly together; and, when lifted up, the smaller pencil remains suspended to the larger one.

In Fig. 2 another experiment is illustrated which shows the contractile power of the surface film. Fold a piece of thin paper into the form of a little box about six inches long and half an inch wide and high. On pouring

FIG. 2.

water into it, the surface film of water will draw the sides of the box together, thus proving that it is in a constant state of tension, like a piece of stretched rubber cloth.

It is well known, that, owing to the tension existing on the surface of water, needles, pens, and even small coins, may be made to float if carefully placed upon it. In Fig. 3 is illustrated an experiment which shows the reverse of this phenomenon, and will well repay the slight amount of trouble necessary to prepare the apparatus. A good-sized cork is taken, and to the lower end is attached a small vessel, which may be conveniently made out of a thimble. At the upper end is placed a ring of very fine, *bright*, and *clean* iron or copper wire, supported by two other wires fastened into the cork. The ring should be about four inches in diameter. The apparatus is then placed in a vessel of water, and sand or fine shot placed in the thimble until it is balanced so that it floats with the ring from one-quarter to one-half of an inch above the surface. If the ring is then pressed down below the surface, the tension of the film will be great enough to prevent the ring breaking through it; and it will remain just underneath the surface, which is pressed up a little, and rendered slightly convex. Now, if a drop of

FIG. 3.

ether be placed inside the ring, the surface tension is diminished, and the ring rises up through the water as if propelled by an unseen force. Some care is necessary to have this experiment succeed, the principal precaution being, to have the wire ring perfectly clean and bright. It is better to slightly grease it by drawing it through the fingers.

The intense coloring power of the aniline dyes can be made the occasion of an amusing experiment by which a white rose or other flower is apparently changed to a different color by sprinkling it with cologne. Some aniline red or other color is finely pulverized, and a very little of it previously dusted over

FIG. 4.

the flower It will be quite invisible; but if alcohol or cologne is blown over it from an atomizer, the dye is dissolved, and its color immediately appears. The illustration (Fig. 4) shows the experiment being performed

upon a rose-bush; but the magical change of color can be made equally well upon a piece of cloth, paper, or even the hand, and will invariably cause much surprise and wonderment.

THE MEGALITHIC MONUMENTS OF CARNAC.

In the French province of Brittany there still exist many relics of that strange prehistoric race which was so widely scattered over the world, if we may assume that monuments of similar form and construction indicate a similarity of race, and not, as seems more reasonable, to attribute the resemblance of these simple structures to the natural development of the human mind in widely separated countries, and in races not ethnologically connected.

These prehistoric monuments occur abundantly in Western Europe and Great Britain. The celebrated "Druids' Temple" of Stonehenge is one of the best-preserved, although it is not likely that the Druids had any thing at all to do with its construction. Little or nothing is really known about these structures, and the time and purpose of their erection, and the race of men who built them, are still an unsolved mystery.

These monuments vary in size from single stones, or groups of two or three, to such enormous collections of stones as are found at Carnac in Brittany, a view of which is given in the accompanying engraving, copied from a photograph. At present there are about five hundred stones, regularly arranged to form enclosures and roads. In the sixteenth century it is said that ten or fifteen thousand stones were visible, extending over six miles of country; but in the course of time the land has been brought under cultivation, and the stones have been removed or destroyed by the inhabitants. This vandalism continued until the past year, when the French government appropriated the land for the purpose of perpetually preserving this invaluable relic of prehistoric times.

It seems evident that these immense works could be of no practical use to their builders, and it is highly probable that they were either erected as memorials of departed heroes and important events, or else as temples for use in connection with their religious rites and superstitions. Whatever the motive that led to their erection, it must have been a powerful one, as the amount of work indicated by such structures as Carnac or Stonehenge must have been immensely great, especially to such savage or semi-civilized people as we conceive the men of early times to have been. It is useless to speculate, however, upon their condition or the extent of their civilization until we have more actual information. In the case of Stonehenge, its builders must have had some astronomical knowledge, for it is so laid out, that, at the time of the summer solstice, the rays of the rising sun fall exactly upon the central "altar-stone," casting thereon the shadow of a large upright stone placed before the door. This certainly indicates a condition above that of actual barbarism. As these ancient builders toiled at their arduous task, they doubtless thought that the fame and history of their work would last as long as the earth itself; but a few hundreds or thousands of years only have since passed, and not a single fact in connection with them remains known. Who can say whether a similar fate may not befall the more extensive works of modern times, and that in a few thousand years their immense ruins may be only an object of curiosity and speculation to the people then living on the earth?

[Original in *The Popular Science News.*]

THE TENDENCY OF MATTER AT THE SURFACE OF THE EARTH.

BY W. A. ASHE, F.R.A.S.

[*Concluded.*]

It is evident, that, if on the surface of such a solid there is a film of matter more responsive to the moving force than our solid's arrested particles, it will proceed towards the equator and the solid of equilibrium, beyond symmetrical arrangement about the more immovable portions of the figure. It seems evident, therefore, that the most natural conclusion for us to draw from the visible evidence presented by a rotating oblate spheroid, is, that its present outline is a natural result of the forces that are acting on it; from which there are but two further conclusions to be drawn, — one, that the solid has attained equilibrium, in which the different media composing it are arranged symmetrically about it in the approximate order of their specific gravities, and that they have no tendency to further movement; the other, that the motion of the particles towards the above condition and arrangement was arrested before either had been reached, and that, as a result of the order of arrestation, depending as it did on the nature of the several media, there has resulted a solid of unsymmetrical arrangement of such sort, that those which were first arrested in their motion equatorwards would be more nearly spherical than those latter; and that, while the condition and position of the first would prevent the latter reaching the outline of the solid of equilibrium, it would be more near it than in the case of those first arrested; so that, if we accept the earth as being an illustration of what we wish to maintain, we should find the spheroid containing the solids less oblate than that containing the liquids, whilst that of the atmosphere should be the most oblate of all, or have the greatest difference between the polar and equatorial diameters. We have, therefore, to conclude that, instead of there being any tendency, on the part of the waters of the earth, to form "two vast polar oceans," or of the atmosphere, or of the corresponding elements of any other member of the solar system, there is either symmetrical arrangement, because of the solid of equilibrium having been attained, or, failing this, that the tendency on the part of these aqueous, atmospheric, or other elements is to accumulate about the equator.

The full consideration of the question is affected by the possibility of the momentum of the particles, in moving from the sphere into the spheroid, carrying them beyond their position of equilibrium, — a possibility that might result in the spheroid being over-developed when its particles were at last brought to rest, — a possibility, however, without a great amount of probability in it; for it does not seem possible to suppose that during the earlier phases of existence of the members of our system, a phase in which rotational velocity was undoubtedly increasing whilst the transferrence of the particles towards the equator was being effected, and at the same time radiation and consequent gradual solidification — resulting in a lessening ability amongst the particles to respond to the translating force — are simultaneously proceeding, could by any possibility result in an over-developed solid: we may, therefore, proceed to the consideration of other reasons that might be held as sufficient to account for this assumed tendency.

The most plausible reason that could be advanced would be the assumption that the diurnal motion is decreased and decreasing from its maximum value, — an assumption that is entirely unsupported by the evidence, which, on the other hand, almost conclusively proves that our diurnal motion has a fixed or so slightly altering value, that the most careful measures of it, which the most precise of astronomical methods permit of, point to its unvarying nature; so that although there is no evidence of there not being a change in its value of

such insignificance that these methods and the lapse of time have been insufficient for its discovery, yet, even if we admit the existence of change in the value, insignificant as it must be in amount, it must still be a question what the *direction* of that change is, and what its effect, therefore, on the tendency of matter. It seems almost certain then, without considering more in detail what their nature may be, that there are retarding influences effective on the earth's diurnal motion which are practically counterbalanced by equally well-known accelerating causes, and that the earth is in the middle period of its existence as a member of our system, of which the three stages are, "Youth with increasing, middle age with uniform, and old age with decreasing, velocity of rotation."

It would be possible to reason out a pole-ward tendency in the waters of the earth if we could assume that they occupied a spheroid of less corresponding diameters than those of the mean earth; but this is not a tenable argument, because we know that the land above sea-level is much less than the depressions below the same. This, together with the fact that the waters of the earth are of less specific gravity than the mean earth, obliges us to conclude that the surface of the water-spheroid is at a greater distance from the centre of the earth than the mean surface of the same from the same: therefore, whatever the amount of the tendency on this account, its direction must be equator-wards.

It is not possible to produce evidence of the direction of the actual movements of the waters of the earth, because of the difficulty of deciding between the effects of local and what might be distinguished by the term of "physical" disturbances. The evidence at the present, obtained from observations extending back nearly two centuries, proves that the waters of the earth are leaving the arctic circle at the rate of about four feet a century; and, although this is not advanced as proof that there is a physical tendency equator-wards, it is meant to point out that there is no present evidence for the direction of the assumed tendency.

The particles of a sphere, or spheroid, are in equilibrium when the normal to the curvature (or the perpendicular to the tangent at such points) coincides with the vertical (or the plumb-line) at every point. If there is a want of coincidence between the two, the resulting tendency will be in the same direction as that towards which the vertical, or plumb-line is deflected, with reference to the normal. Now, within the limits of accuracy, that the different methods permit of, which have been used to determine the figure of the earth, there appears to be a coincidence between the vertical and normal to the mean curvature; the irregularities in this mean curvature, although not pointing to any systematic departure from the true spheroid, do not permit of our concluding other than that there is equilibrium in the arrangement of the particles of the earth; and, although the existence of an arctic ocean is generally considered sufficient evidence to prove this tendency, in opposition to the equally certain existence of an antarctic "continent," it seems to me that an equatorial tendency might be just as reasonably maintained by reason of the very decided accumulation of the waters of the earth there.

There was a time, and that not so many years ago, when, in accordance with this popular line of argument, it was assumed that the earth's atmosphere had its greatest depth at the poles, — an opinion that prevailed till the careful compilations of Buchan proved that the tendency of the atmosphere was to collect about the equator, or, more strictly speaking, in such order that the minimum pressure is at the poles, the maximum at about latitudes 4° °, with a belt of less pressure at the equator; and although it is not my intention here, to argue out a corresponding arrangement for the waters of the earth, this arrangement of the atmosphere is very positive evidence against the belief in the pole-ward tendency of matter at the surface of the earth; whilst, on the other hand, it is corroborative evidence of the most positive kind, of either one of the conditions I have pointed out as the only possible — a condition of equilibrium or a tendency towards the equator.

The Quebec Observatory, *July*, 1888.

[Original in *The Popular Science News.*]

THE ORIGIN OF THE SNEEZING FORMULA.

BY LEILA W. USHER.

The custom of saying "God bless you," or some equivalent expression, when a person sneezes, is ancient and very widely extended. In fact, it is doubtful if there is a country in the world where traces of it cannot be found. Consequently the very general belief that the custom took its rise in one of the symptoms of the plague in Italy in the days of Gregory the Great cannot be credited. Its origin dates much farther back; even, it may be said, beyond the limits of history. For in the religious ideas and social customs of primitive men is found the clew to this strangely universal superstition. Among these primitive people the sneeze was sometimes considered as an auspicious sign, sometimes as a most unlucky omen; but that it was due to the presence of spirits, either good or evil, was the belief of all. For early men supposed the soul to go in and out of the body, and so with other spirits, especially such as are thought to enter into the patient and affect him with disease. Therefore, in case of illness, a person by the act of sneezing is believed to cast out the evil spirit that has been the unfortunate cause of his suffering.

For instance, the North-American Indians, as well as the natives of the Indian Archipelago and also the Polynesians, believe not only in the existence of a Supreme Power, but also in the existence of inferior spiritual beings, resembling the fairies of Northern Europe. And these people believe the sick to be affected by these spirits rather than by any natural cause: consequently the medicine-man proceeds to expel the evil spirit instead of otherwise attempting to cure the diseased body. Thus, we see, arose the superstition that a sneeze is a sign that a sick person will be restored to health: and so all who go to see him ask if he has sneezed; and if he has not, they then say, "The disease is great." The Norwegian peasants still believe that if a sick person sneezes, he will not die; and their custom when a child sneezes, is to say "Grow: it is a sign of health." They also believe that any thing a person is thinking of when he sneezes will be sure to come true. Then, among the savages of Borneo and Central Africa there is the belief that man has a double form, the one corporal and the other spiritual; and that even in life the soul, or spirit, may leave the body; and that sickness, or evil spirits, deprive the body of its spiritual companion. The natives of Nicaragua, California, Java, and West Australia describe the soul as the air or breeze which passes in and out through the mouth and nostrils; the Greenlanders are said to reckon two separate souls, — the breath and the shadow; while the Tyrolese peasants still fancy that a good man's soul issues from his mouth at death in the form of a little white cloud, — all going to show how universal has been the belief in the existence of spirits that had the power to go in and out of the body, and were naturally believed to be most liable to enter or be expelled at such times as one sneezed or yawned. Among the Algonquin Indians a sick person is supposed to have his shadow, or other self, temporarily detached from his body; and the convalescent is at times reproached for "exposing himself before his shadow was safely settled down on him." Then, in the arctic regions and in Australia sickness and death are supposed to be caused by the influence of spirits who have been employed by enemies to injure them; and the same idea is seen in Scotland and Northern Africa, where they believe that there are ghosts of the living who are exceedingly troublesome and vindictive; while in Polynesia not only animate, but inanimate, things are supposed to lose their spirits, — the little gods stealing the shadows of those things to which they take a fancy. Then, too, it seems that to primitive man the mortality of the body was an incredible fact; and it was therefore believed that a person who died was simply carried away by the "good people," meaning the fairies. The dead man accordingly was not dead: he retained his old appearance, and often visited his friends, especially at nightfall: and they thought, that, since his departure from this life, his powers and privileges were mysteriously enlarged and extended. Because of this belief, the Hindu, for example, slays himself before his enemy's door, in order to acquire greater power of injuring him. Tylor, in his *Primitive Culture*, says that "there were toward the close of the last century two Brahmans out of whose house a man had wrongfully, as they thought, taken forty thousand rupees, whereupon one of the Brahmans proceeded to cut off his mother's head, with the professed view, entertained by both mother and son, that her spirit excited, by the beating of a large drum for forty days, might haunt, torment, and pursue to death the taker of their money and those concerned with him." In fact, so widespread is found to be this superstitious belief regarding the influence of spirits, ghosts, and fairies, that we here get a clew to the practice of invoking the name of the Deity as protection against their agency; for in the name of the Deity is thought to rest the mysterious power of driving away all evil spirits, as well as rendering them powerless to do harm. So the Highlanders believe that when a person sneezes, he is liable to be stolen by fairies, unless protected by some one invoking the name of the Deity. And the New-Zealander, with a similar idea, makes use of a charm to prevent harm when a child sneezes. But the Scandinavian and Celtic races credited their spirits with even more serious influence, for they thought a sneeze or yawn enough to convert a person into a real fairy, unless the name of the Deity was invoked in time to prevent the disaster.

The negro races of Africa also regard the act of sneezing with great dread, for they believe it to indicate the influences of "ancestral spirits," which they must make haste to propitiate. The Zulu must have the same idea, for he exclaims when he sneezes, "The ancestral spirit is with me, for it is that which causes me to sneeze; let me hasten to praise it!" Then, the Moslem, when he sneezes, is saluted by his friends with the formula, "Praise to Allah!" — a custom, it is said, that is conveyed from race to race wherever Islam extends. And in Guinea, even during the last century, when a principal person sneezed, all present fell on their knees, kissed the earth, clapped their hands, and wished him happiness and prosperity. A custom involving the same idea is still kept up in the Tyrol: it is that of crossing one's self when one yawns, lest something evil should come into one's mouth. In France an

indication of the survival of this superstition is seen by the following quotation from a *Book on Rules and Civilities* of the year 1685: "If his lordship chance to sneeze, you are not to brawl out, 'God bless you,' but, pulling off your hat, bow to him handsomely, and make the obsecration to yourself." The custom among the Jews, when a person indulges in a sneeze, is to ejaculate, "A long life to you." In Italy they say "happiness," and in Germany the people exclaim "*gesundkit!*" ("health!"). We also find that this singular superstition was very universal among the Greeks and the Romans, and is often referred to by classical authors. Aristotle, for instance, has devoted one of his Problems to the question why the custom of invoking *Jupiter Stator* was indulged in as a safeguard against the dangers of a sneeze, and tells us that his countrymen regarded the sneeze as sacred. It seems that in Greece it has always been considered an unlucky omen for any one to sneeze at the commencement of an undertaking; and a sneeze to the left was regarded as unlucky, while to sneeze to the right was thought a most lucky sign. Homer carries back this superstition to Olympus, and to the gods, who make the vaults of heaven ring by invoking Jupiter when one of their number indulges in the ominous act of sneezing.

Thus we see, that from primitive times, on through successive stages of culture, to the present age, can be traced this sneezing superstition with its attendant joys and terrors. And though this superstitious custom had its root deep in primeval philosophy, and its real signification had long since faded from men's minds, yet the old formula remained, and was handed on; showing how slowly and painfully humanity gives up old customs, even though they have dwindled to mere survivals of primitive culture.

HOW A MOUND WAS BUILT.

"WHILE exploring mounds in Ohio this season, under the direction of the National Bureau of Ethnology," says Mr. Gerard Fowke in a paper prepared for *Science*, "I used great care in the examination of one mound in Pike County, in order to ascertain, if possible, the exact method of its construction.

"The mound was built upon the site of a house, which had probably been occupied by those whose skeletons were found. The roof had been supported by side-posts, and at intervals by additional inner posts. The outer posts were arranged in pairs a few inches apart, then an interval of about three feet, then two more, and so on. They were all about eight inches in diameter, and extended from two and a half to three feet into the ground, except one a few feet from the centre, which went down fully five feet. All the holes were filled with the loose dark dirt which results from decay of wood. A few contained fragments of charcoal, burned bones or stone, but no ashes; nor was the surrounding earth at all burned.

"Around the outside a trench from three to four feet wide, and from eighteen to twenty inches deep, had been dug, to carry away the water which fell from the roof. Near the middle of this house, which measured about forty feet from side to side, a large fire had been kept burning for several hours, the ashes being removed from time to time. The ash-bed was elliptical in form, measuring about thirteen feet from east to west, and five from north to south. Under the centre of it was a hole, ten inches across and a foot deep, filled with clean white ashes in which was a little charcoal, packed very hard. At the western end, on the south side (or farthest from the centre of the house), was a mass of burned animal bones, ashes, and charcoal. This was continuous with the ash-bed, though apparently not a part of it. The bones were in small pieces, and were, no doubt, the remains of a funeral feast or offering.

"After the fire died down, rude tools were used to dig a grave at the middle of the house. It measured ten feet in length, from east to west, by a little more than six in breadth. The sides were straight, slanting inward, with rounded corners. The bottom was nearly level, fourteen inches deep, but slightly lower at the centre. Over the bottom ashes had been thinly sprinkled, and on these a single thickness of bark had been laid. The sides had been lined with wood or bark from two to four inches thick. When this was done, two bodies were placed side by side in the grave, both extended at full length on the back, with heads directly west. One, judging from the bones and condition of the teeth, was a woman of considerable age. She was placed in the middle of the grave. Her right arm lay along the side, the left hand being under the pelvic bones of the other skeleton. This was apparently of a man not much, if any, past maturity. The right arm lay across the stomach, the left across the hips. This skeleton was five feet ten inches in length; the other, five feet four inches.

"The space between the first skeleton and the south side of the grave was covered with the ashes that had been removed from the fire. Beginning at the feet in a thin layer, — a mere streak, — they gradually increased in thickness toward the head, where they were fully six inches thick. The head was embedded in them. They extended to the end of the grave, reaching across its entire width, and coming almost but not quite in contact with the other head. A considerable amount of the burned bones lay in the south-western corner of the grave, and the ashes along this part curved up over the side until they merged into what remained of the ash-bed. This had extended to the west slightly beyond the end of the grave.

"As the earth removed from the grave had been thrown out on every side, the bodies were in a hole that was nearly two feet deep. The next step was to cover them. There was no sign of bark, cloth, or any other protecting material above them. They were covered with a black sandy earth, which must have been brought from the creek not far distant. This was piled over them while wet, or at least damp enough to pack firmly, as it required the pick to loosen it, and, besides, was steeper on the sides than dry dirt would have been. It reached just beyond the grave on every side, and was about five and a half feet high, or as high as it could be conveniently piled.

"So far, all was plain enough: but now another question presented itself that puzzled me not a little; and that was, what became of the house? That there had been one, the arrangement of the numerous post-holes plainly showed; but the large earth-mound above the tumulus, or grave, was perfectly solid above the original surface, giving not the slightest evidence that the posts or any part of the house had ever reached up into it. I incline to the opinion that the great fire near the middle of the house had been made from the timbers composing it; that the upper timbers had been torn down, and the posts cut off at the surface, the whole being a kind of votive offering to the dead. At any rate, it is plain that a house stood there until the time the mound was built; and it was not there afterwards.

"For the purpose of covering the grave, sand was brought from a ridge a short distance away. There was no stratification, either horizontal or curving. Earth had been piled up, first around the black mass forming the grave-mound, and then different parties had deposited their loads at convenient places, until the mound assumed its final conical arrangement. The lenticular masses through almost the whole mound showed that the earth had been carried in skins or small baskets. The completed mound was thirteen feet high and about one hundred feet in diameter.

"Two and a half feet above the original surface was an extended skeleton, head west. It lay just east of the black earth over the grave. Sixteen feet south of the grave, on the original surface, and within the outer row of post-holes, were two skeletons extended, heads nearly west. It would seem that the flesh was removed before burial, as the bones were covered with a dull-red substance, which showed a waxy texture when worked with a knife-blade.

"No relics of any description were found with any of the skeletons; but a fine copper bracelet was picked up in a position that showed it was dropped accidentally."

SCIENTIFIC BREVITIES.

MUTILATED CHRYSALIDES. — A correspondent of an exchange gives an account of how a chrysalis of the Monarch butterfly developed while pierced by a pin, the imago appearing in due time. He also pierced some chrysalides of the cabbage butterfly (*Pieris rapæ*), and they also brought forth perfect insects. One of these insects, when hatched, had the pin through the thorax, as if transfixed in the perfect state. Of course, they are badly deformed; but it goes to prove that injuries may be inflicted upon the chrysalides without preventing their development.

DEVIATION OF THE PENDULUM. — A simple method of rendering visible the deviation of the Foucault pendulum has recently been devised by Mr. Campbell. The bob of the pendulum is replaced by a permanent magnet of a cylindrical form, placed with its axis coinciding in direction with the suspending wire. On a point vertically beneath the centre of suspension is swung horizontally a light bar of some magnetic material, carrying a mirror, from which is reflected a beam of light. On putting the pendulum in vibration in the vertical plane which contains the bar, the latter follows the deviation of the pendulum, which is thus rendered very visible by the corresponding reflection of the luminous beam.

IODIDE OF STARCH. — After working upon cholic acid, and more particularly upon an iodized compound of this acid which behaves in a manner analogous to the iodide of starch, F. Mylius reinvestigated the latter compound, arriving at the very unexpected conclusion that pure iodine does not color starch blue; to obtain this coloration the presence of hydriodic acid or of a soluble iodide is necessary. The blue products known as iodide of starch should be compounds of four molecules iodide of starch with one molecule of hydriodic acid or of a soluble iodide.

TWO NEW VEGETABLE PERFUMES are said to have lately become articles of commerce. One of these is a kind of *xylopia* from the province of Chirigui, in Costa Rica. The odor closely resembles that of *Canaga odorata*, and the flowers are now used, like those of that plant, in the manufacture of ylang-ylang. The other is named *ouco*, and is the highly odoriferous blossom of a kind of acacia-tree which is found in Central Africa, and which Serpa Pinto was the first to describe. The *ouco* flowers are brought down the Cubangin River for sale. They cover the trees on which they grow with such profusion, that they fill the atmosphere with the overpowering richness of their scent.

Practical Chemistry and the Arts.

SOAP.

The familiar substance soap is, chemically speaking, a true salt, or combination of an acid with a base. The acids which form soap are obtained from fats and oils, and are known as fatty acids. A great variety of animal and vegetable substances are used in soap-making, such as palm oil, cocoanut oil, olive oil, tallow, lard, and the fat of fishes and other animals. The chemical reaction is the same, however, in all cases. The fatty acids, palmitic, stearic, oleic, etc., exist in the fats, combined with glycerine as a base, forming the substances known as palmitine, stearine, or oleine. Tallow, for instance, is a mixture of stearine, palmitine, and oleine. When these are melted, and boiled with a caustic alkali, such as sodic hydrate, glycerine is set free, and palmitate of soda, or soap, is formed. The reaction expressed by symbols is as follows: —

$$\underset{\text{Palmitine.}}{(C_{16}H_{31}O_2)_3C_3H_5} + 3\,\underset{\text{Sodic hydrate.}}{NaOH} = \underset{\text{Sodic palmitate.}}{(C_{16}H_{31}O_2Na)_3} + \underset{\text{Glycerine.}}{C_3H_8O_3}.$$

In the above reaction hard soap is formed; but if potash had been used instead of soda, a jelly-like mass, known as soft soap, would have resulted, containing the glycerine and impurities present in the substances used. Chevreul, the venerable French chemist, now in his one hundred and third year, was the first to study and explain this peculiar reaction, commonly known as saponification.

It is to be noted that the caustic alkalies, or hydrates, must be used in this process, as the reaction does not occur with the alkaline carbonates which are more commonly met with. In wood ashes the alkali occurs as carbonate, and the lye must be treated with quick-lime to remove the carbonic acid. Carbonate of soda is often added to soap for the purpose of increasing its cleansing power; but it does not enter into chemical combination, and is an undesirable addition. It is never found in the best soaps.

Resin is a common constituent of the cheaper grades of soap, and forms a chemical combination with alkalies. It is not a true soap, however, and is of little value, except to the manufacturer by increasing the weight of the product.

The practical operation of soap-boiling is one requiring considerable skill. The alkali and fats are boiled together for several hours, forming a mass known as soap glue. Common salt is then added, which precipitates the soap from the water, glycerine, and impurities. The soap rises to the top of the mother liquor, which is drawn off by a tap at the bottom of the kettle. This process is sometimes repeated, and the hot soap is then ladled out into wooden frames, where it is allowed to harden into a solid cake, which is afterwards cut up into bars of the desired size by means of a wire. Soap, when freshly made, always contains a large amount of water, which greatly increases the weight, besides causing it to dissolve much more rapidly. For these reasons the manufacturers do not take much pains to lessen the percentage of moisture, and it is much more economical to use old soap that has been well dried.

Castile soap is extensively manufactured in Southern Europe from olive oil. It varies in color from pure white to green. The familiar mottled appearance is caused by mixing copperas with it, which is changed to sulphide of iron by the sodic sulphide present in the lye.

Toilet soap is simply ordinary soap, colored, perfumed, and moulded into fancifully shaped cakes. A poor quality of soap is often used, and its deficiencies masked by the color and odor. A good castile soap is purer and better in every respect for toilet use, and the special brands of soap so extensively advertised by certain American manufacturers are, as far as our experience goes, unexceptionable in purity and efficiency. Transparent soap is made by dissolving ordinary hard soap in alcohol, and allowing it to harden in moulds. It is by this means separated from impurities, and a very good and attractive-looking article results. The alcohol is recovered by distilling and condensing, and used over again.

The fatty acids also unite with lime and other bases, forming insoluble soaps, mostly of little importance. The lime soap is formed when ordinary soap is dissolved in hard water, containing an excess of that base. Soaps of lead, mercury, and iron are used to a small extent in medicine; but the only important compounds of this class are those of soda and potash.

The cause of the cleansing power of soap is even yet somewhat uncertain. According to Chevreul, the soap is decomposed by the water, setting free double fat acid salts and alkali. The alkali removes the dirt, which is taken up by the fat acid salts, and remains suspended in the lather. In some respects this explanation is not quite satisfactory; but whatever may be the cause of the peculiar properties of soap, it is so extensively used, and of so much importance in the daily affairs of life, that the amount consumed by a nation may be taken as a measure of its advance in civilization.

FAST TIME ON AMERICAN RAILROADS.

The liveliest interest was manifested by railroad men in the recent account of the race between the "Flying Scotchman" and the "West Coast Flier" from London to Edinburgh, in which 400 miles were covered by the winner in 7 hours and 25 minutes. This was an average of something over 53½ miles an hour. There was a general jogging of memories, and overhauling of the records of fast railroad trains on American lines; and they show that, although the British and French roads admittedly make much better time habitually than is made on any of the American lines, some astonishing and sustained rates of speed have been attained here when special efforts were expended with that end in view.

The best run on record in this country which can be fairly compared with the English run was made over the West Shore road, from Buffalo to New York, on July 9, 1885, when 426 miles were covered in 7 hours and 27 minutes. Quite a large number of railroad men happened at Buffalo together, *en route* for New York. It was decided to see how quickly they could move over the new road. At the start the railroad men had their watches out, and soon the mile-posts were flying past every 43 seconds. That speed was held so steadily, that the greater part of the run was made at the rate of 45 seconds to the mile, or from 70 to 80 miles an hour. From East Buffalo to Genesee Junction, 61 miles, took 56 minutes; from East Buffalo to Newark, 93.4 miles, 97 minutes; from Alabama to Genesee Junction, 36 3 miles, 39 minutes. The 97 minutes to Newark included stops of 9 minutes, making the actual running time for the 93.4 miles, 88 minutes. From Newark to Frankfort, where the conditions for running were not so good as before, the run of 108.3 miles was made in 134 minutes, including 17 minutes for stops. From East Buffalo to Frankfort, 202 miles, the time was 240 minutes, of which 35 minutes were consumed in stops. The journey was timed with the utmost care for the purpose of tabulation. In the table there are marked several miles which were made at the speed of 78 miles an hour, one at 84 miles, and the next, between Genesee Junction and Chili, at 87 miles.

On Oct. 8, 1885, over the same road, a burst of speed was tried for 11 miles between Genesee Junction and East Buffalo, to satisfy Superintendent J. E. Layng, who was on the train. The run occupied 512 seconds, — an average rate of 74 miles an hour. Three of the miles were made at the rate of 80 miles an hour, one at 77, and one at 75.

On the New York Central road a newspaper train with two cars, weighing 60 tons, hauled into Syracuse Sunday morning, Aug. 8, 1886, at ten o'clock, an hour late. The train was booked to go from New York to Buffalo in 9½ hours Orders came to try to make up the time on the further run of 148 7 miles to Buffalo. John W. Cool, one of the best engineers on the road, mounted his cab, bound to obey the order. He started out at 54½ miles an hour. At the end of the three miles his speed increased to 66 miles an hour, and then to 74½. He stopped at Rochester for water, and slowed up after passing Crittenden. His average speed from Syracuse to Rochester was 67¼ miles per hour, from Rochester to Buffalo 63 72 miles per hour, and from Syracuse to Buffalo 65 6 miles an hour. The run of 148 7 miles was made in 136 minutes.

The most remarkable long-distance run on record was when the Jarrett-Palmer combination went from New York to San Francisco in half time, or 3½ days. Their train left the Pennsylvania Station in Jersey City at 12 53 on the morning of June 1, 1876. They were not to make a stop until they reached Pittsburgh. An engine and baggage-car, on the approach of the special to Harrisburg, got up a speed of about 50 miles, and passed mails to the special by running along an adjoining track for several miles, while the mail-bags were thrown from train to train The run to Pittsburgh, 438½ miles, took 10 hours and 5 minutes, — an average of 43½ miles an hour, notwithstanding the Alleghanies. From Pittsburgh to Chicago, 458 3 miles, took 11 hours and 6 minutes, — an average of 42 1 miles, including 25 stops and 4 changes of engines. From Chicago to Council Bluffs, 491 miles, took 11½ hours, — an average of 42.6 miles, although there was a record for part of this journey of 62 2 miles. Over the Union Pacific the run of 1,032 8 miles from Omaha to Ogden was made in 24 hours and 14 minutes, at an average of 41 miles, and a maximum of 72 miles an hour. The brakes became worn at Ogden, and hand-brakes had to be used, retarding the onward journey somewhat. San Francisco was safely reached at 12 57 on June 4, and the running time for 3,313½ miles was 84 hours 17 minutes, — an average of 40 miles an hour. — *N. Y. Times.*

FILTRATION WITH FILTERS OF METALLIC FELT.

GOOCH'S admirable filter of asbestos felt is too widely known and extensively used to require description, and his ingenious modification of it, in which volatile felts are employed, is recognized as forming a useful extension of the method for certain applications. Some time since, it occurred to me that another modification might be wrought if we were to use, for the manufacture of the felts, metallic salts which were easily decomposed on ignition, and which, when decomposed, left the metal as a spongy, coherent residue. Such a salt is found in the ammonium platinic chloride, and by its use I have obtained the metallic felt, which served very nicely for this purpose.

To produce this filter I precipitated platinum chloride with ammonium chloride, using a slight excess of the reagent, and washed the salt thoroughly, first with water and then with alcohol. Then, taking a Gooch filtering crucible of platinum, I placed it on a thick piece of bibulous paper, and poured in the moist salt. The alcohol ran through the perforations in the crucible, and was absorbed by the bibulous paper, while the salt remained behind; the filtering crucible being filled in this way to a height of about five millimeters. The crucible was then carefully cleaned and dried, the cap and cover put on, and the whole ignited, thus driving off the volatile constituents, and leaving a spongy, coherent residue of metallic platinum well distributed over the perforated bottom of the crucible. In order to prevent the sponge from cracking and curling, it was found essential to dry and ignite the salt quite cautiously; but in some instances where cracks did appear they were easily and effectually closed by gently rubbing with a glass rod, while in other cases the crevices were filled with a fresh portion of the ammonium platinic chloride, and the drying and igniting repeated. The latter method was also employed when it was thought desirable to increase the thickness of the felt. After a short trial the preparation of the felt became quite easily and readily accomplished. The prepared filters are used in the same way as Gooch's asbestos filters are, the caoutchouc gasket described in my paper on the "Use of Porous Cones in Filtration" being employed to secure an air-tight joint. The platinum felt may be easily removed, when desired, by means of a spatula; the small portions remaining in the perforations being pushed out with the point of a needle.

I have repeatedly prepared these filters in the manner above described, and have filtered with them such preparations as freshly precipitated barium sulphate to my entire satisfaction. Not only that, but, by treating the precipitates with their proper solvents, I have been able to clean the felt so that the same filter could be used repeatedly. — C. E. MUNROE, *in Journal of Analytical Chemistry.*

HOW CELLULOID IS MADE.

WHILE everybody has heard of, or seen, or used celluloid, only a few know what it is composed of or how it is made. The following is a description of the process carried out in a factory near Paris, for the production of celluloid: —

A roll of paper is slowly unwound, and at the same time is saturated with a mixture of five parts of sulphuric acid and two parts of nitric acid, which falls upon the paper in a fine spray. This changes the cellulose of the paper into pyroxylin (gun cotton). The excess of the acid having been expelled by pressure, the paper is washed with plenty of water until all traces of acid have been removed. It is then reduced to a pulp, and passes on to the bleaching trough.

Most of the water having been got rid of by means of a strainer, the pulp is mixed with from twenty to forty per cent of its weight in camphor, and the mixture thoroughly triturated under millstones. The necessary coloring having been added in the form of powder, a second mixing and grinding follows.

The finely divided pulp is then spread out in thin layers on slabs; and from twenty to twenty-five of these layers are placed in a hydraulic press, separated from one another by some sheets of thick blotting-paper, and are subjected to a pressure of 150 atmospheres, until all traces of moisture have been got rid of. The matter is then passed between rollers heated to between 140° and 150° F., whence it issues in the form of elastic sheets. — *The Inventor.*

BALLOONING WITH NATURAL GAS.

THE first balloon inflated with natural gas ever sent up arose from Riverside Park, near Anderson, Ind., Aug. 14. It has been a question as to whether natural gas would float a balloon to any considerable height, says a writer from that town. This one was filled by a pipe from a well until the gauge indicated that the silk, which was enclosed in a strong netting, was bearing twenty pounds pressure, when George Ayers, an amateur aeronaut, climbed into the basket, and the balloon was cut loose. It rose steadily until an altitude of about twenty-five hundred feet was reached, when a current of air was struck which bore the balloon and its single passenger away to the south-east, since which nothing has been seen or heard from him. — *Progressive Age.*

PRACTICAL RECIPES.

A FLEXIBLE CEMENT is made by melting together equal parts gutta-percha and white-pine pitch, which softens on the water bath, and is not deteriorated by remelting.

A PASTE suitable to preserve the gloss of patent leather, and prevent cracking, is made of wax, with a little olive-oil, lard, and oil of turpentine, mixed when warm, to be of the consistency of thick paste when cooled.

DARKENING THE NATURAL HUE OF WOOD. — This is effected by a solution composed of equal parts of manganate of soda and crystallized Epsom salts, dissolved in twenty to thirty times the amount of water, at about 144°. The less water employed, the darker will be the hue.

FUSIBLE ALLOY. — An alloy which melts at a lower temperature than the magic spoon does is obtained by melting together 48 parts bismuth, 31 of cadmium, 10 of lead, and 20 of zinc. This alloy melts at 135° F.

A SOLVENT FOR RUST. — It is often very difficult, and sometimes impossible, to remove rust from articles made of iron. Those which are most thickly coated are most easily cleaned by being immersed in a solution, nearly saturated, of chloride of tin. The length of time they remain in this bath is determined by the thickness of the coating of rust. Generally twelve to twenty-four hours is long enough.

AN INCOMBUSTIBLE WICK. — Fine wood sawdust, 4 parts; powdered fire-clay, 2 parts; powdered glass, 1 part; cotton or cotton dust, 1 part; sea-sand, 6 parts. This mixture, moistened, dried, and fired at a full red heat for half an hour, is stated to yield a very permanent and porous material for lamp-wicks.

TO REMOVE PAINT FROM A WOOD-CARVING without damaging the wood, mix one part by weight of pearl-ash with three parts lime by slacking the lime in water, and then adding the pearl-ash, making the mixture of about the consistency of paint. With an old brush lay the above over the whole of the work required to be cleaned; let it remain fourteen or sixteen hours, when the paint can be easily scraped off.

A FRENCH POLISH can be made as follows. Though rather complicated, it is worth the trouble: Take one pint of soft water, and mix with it twice as much vinegar; break in small pieces one-quarter pound of glue; stir it into the vinegar and water with half a pound of logwood chips, a quarter-ounce of finely powdered indigo, a quarter-ounce of the best soap, and a quarter-ounce of isinglass. Put all this mixture on the fire, and let it boil gently for at least a quarter of an hour; strain it carefully, put it in bottles, and cork tightly; when cold it is ready to be used. A clean, soft sponge should be used to apply it.

AN ELASTIC MUCILAGE. — Dissolve 1 part of salicylic acid in 20 parts of alcohol, add 3 parts of soft soap and 3 parts of glycerine. Shake thoroughly, and add the mixture to a mucilage prepared from 93 parts of gum-arabic and the requisite amount of water (about 180 parts). This mucilage is said to keep well, and, when it dries, to remain elastic without tendency to cracking.

INDUSTRIAL MEMORANDA.

THE CONTRACTOR who laid the new railway line from Philippopolis to Constantinople was, under a loosely drawn contract, allowed so much per kilometer. The result is one of the most extraordinary zigzags ever seen in railway construction.

WASTE SILK FOR STEAM-PIPE COVERING. — Experiments on the relative advantages of different covering material for steam-pipes, recently made at Saint-Denis, proved waste silk the most effectual of all non-conducting compositions; and it is stated, that, notwithstanding its high price, this material is greatly used.

HOW THE CHINESE DRILL WELLS. — The French Abbé Huc thus describes the system of deep-earth boring practised in the district in which he has for some time resided. A wooden tube six feet in length is first driven down through the surface soil. This tube is held at the surface of the ground by a large flagstone, having a hole in the centre to allow the tube to pass through and to project a little above it. A cylindrical mass of iron, weighing about four hundred pounds, hollow and pointed at its lower end, and having lateral notches or apertures, is jerked up and down in this tube at the end of a lever, from which it is suspended by a rope. This kind of "monkey" disintegrates the rock, the *débris* of which, converted into sludge by water poured in, finds its way through the lateral apertures into the interior of the cylinder. By raising the latter at intervals, this sludge is removed from the bore-hole. The rate of boring in rock of ordinary hardness is one foot in twelve hours. Only one man is employed at one time to work the lever. By this means wells of eighteen hundred feet deep are sunk in about two years by the labor of three men, relieving one another every six hours.

ELECTRIC MOTORS. — The *Manufacturer and Builder* declares that there are at present no less than ten thousand electric motors in use throughout the United States. The uses to which these are put are extremely varied; they embrace the running of sewing-machines, printing-presses, and ventilating-fans; operating dental instruments; driving street-cars; coal and ore haulage in mines; pumping water; washing bottles; and in machine-shops, shoe-factories, book-binderies, knitting-works, etc., for miscellaneous uses, they are becoming quite common.

Home, Farm, and Garden.

[Original in *The Popular Science News.*]

EDIBLE MUSHROOMS.

BY W. J. CHASE.

The order *Cryptogamia* to which fungi belong, is but imperfectly classified and understood by the best botanists. It is not surprising, therefore, considering the scarcity of sources of information, that the majority of mankind is so ignorant of the value of many of our most common mushrooms. In this respect Americans, however ready generally to avail themselves of opportunities, are far behind many other nations, with whose peasantry, especially, different varieties of fungi are highly appreciated as articles of food.

Both fear and prejudice combine to deprive us in the mushroom of nature's own substitute for meat. Absorbing oxygen, and giving out carbonic acid, as the fungi do, it is not strange that many of them have most delicious meat flavors. The *Fistulina hepatica*, growing on the oak, resembles beefsteak both in appearance and flavor; some of the *Agarics* have a flavor of stewed lamb kidneys, and other members of the same family and many of the *Hyduci* are delicate vegetable oysters.

When it is considered that there are in this country at least sixty edible varieties of the *Agarics* alone, our lack of appreciation of nature's beneficence becomes more apparent. Possessing in generous abundance, as they do, the nitrogenous elements which give to food its most nutritive qualities, mushrooms seem especially fitted to tempt the appetite, and furnish a nourishing diet at a season of the year when meat palls on the taste.

The proper way to cook them, connoisseurs declare, is either to broil them, with pepper, salt, and butter, over a quick fire, or to stew them in milk, as oysters are often prepared. It is probable that exceedingly few of the larger fungi are very deleterious when cooked, as heat renders comparatively harmless whatever poison they contain. Yet, though a large number of species are reputed to be edible, many of these are so closely allied in form, color, haunts, and other characteristics to undoubtedly poisonous varieties, that it is decidedly unsafe for any but a specialist to attempt to discriminate between them. But, after all, there are a good half-dozen esculent mushrooms the characteristics and distinguishing features of which are easily acquired. The same care, however, must be employed in gathering them for the table as is necessary in choosing other articles of food. Just as tainted meat or decayed fruit is avoided, so must the over-ripe fungi be discarded; for those that are perfectly harmless when fresh, may very soon become noxious and unfit to be eaten.

The *Agarics*, on account of their abundance, should head the list of esculents. To this class the mushroom of commerce belongs. Nevertheless, these are the least safe for the beginner, as the edible members are very easily confounded with their dangerous brothers. The following distinguishing features will, however, identify the most common safe ones. The beginner must not fail to bear in mind that *all* these characteristics enumerated must be distinctly present in order to insure edible qualities. It is never found in woods or in tall grass, but in pastures, or on lawns where the grass is kept close cut. The gills are at first a delicate pink, and later a purple color, and are wholly free from the stem; the spores also are purple. Around the middle of the stem there is a ring, or collar, and the outer skin projects a little over the margin of the pileus, or cap. The two most common varieties are the meadow mushroom (*Agaricus campestris*) and the horse mushroom (*Agaricus arvensis*); but these varieties so run into each other, that they are hard to distinguish. They are both perfectly safe. Another is the elm-tree mushroom (*Agaricus ulmarius*), found, as its name implies, on the elm, and only in the fall. It has broad, white gills, supported by a solid, thick stem. The top is at first light yellow and smooth, and later spotted and cracked. It is said to be the only large fungus with gills and white flesh that grows on that tree.

A species allied to the *Agarics* is the *Coprinus*, of which the maned mushroom (*Coprinus comatus*) is the most easily recognized. It is ovate in shape, with a brown, smooth top, but near the base the outer skin ruffles up, making a white mane, or fringe. It should be eaten only when young, while the gills are still white or slightly roseate in tint. About the roadsides is the place to look for it, but it should never be picked when growing near offal or dust heaps. This species is deliquescent, melting into an inky fluid soon after arriving at maturity.

Another family is that of the *Russulæ*, of which perhaps only one is safe for beginners, and that should never be eaten without a previous thorough examination, to make sure its identity. All the parts of the mushrooms of this family are very brittle, snapping into small pieces on being bent. The *Russula alutacea* has a bright-red top, buff-colored gills, and a thick, short stem; but this description applies very truthfully to two poisonous varieties of the same species. The only way to distinguish them is by breaking off a small piece and tasting. The edible variety is either tasteless or has a mild flavor of chestnuts. If it bites and stings the tongue ever so slightly, or if, on being broken, milk or juice exudes, reject it.

For beginners the safest of all species is the *Lycoperdon*, or puff-ball, which grows in sandy pastures and open woods. The giant puff-ball (*Lycoperdon giganteum*) is a very common variety. To be fit to eat, it should be fresh, perfectly smooth on the outside and perfectly white, and cream-like within; and it should be eaten very soon after being picked, as it decays very rapidly. This family has no dangerous members.

The *Hydnei* are also a safe species. They are easily distinguished by their tooth-like spines on the under side of the pileus. The spreading hydnum (*Hydnum repandum*), found in the woods or in woody places, is a perfectly safe variety. It is usually yellow or yellowish red, and always of firm flesh. The stem is generally either very indistinct or deformed; and the pileus, often of irregular shape, sometimes has one side higher than the other.

The genus *Boletus* possesses several edible species. These all have pores or tubes instead of gills, and, unlike most of the *Polyporei*, grow from the soil. The thick pileus should be of a russet brown or gray color, with tubes varying from a pale yellow to a greenish brown. The stem is distinct, and thickest at the base. The white flesh, on being exposed to the air, should not change its color. They are found in damp, shady woods.

These are but a few of the many esculent varieties; but the young mycophagist, after becoming familiar with these, can easily enlarge his acquaintance. It is well, perhaps, to caution against recklessness, and to repeat that only the fresh fungi are fit for food.

It might be well to close this sketch with the suggestion that sweet oil taken liberally, with or without whiskey, will neutralize to a great extent the noxious qualities of the poisonous varieties. A reasonable amount of care, however, will render this suggestion unnecessary.

[Original in *The Popular Science News.*]

ON POMOLOGY.

BY R. W. SHUFELDT, M.D.

There has recently been undertaken by the United States Department of Agriculture a very important line of investigation — we refer to its work upon pomology, or a study of the tropical and semi-tropical fruits grown within the limits of this country. The Department has just issued its first bulletin upon this subject, entitled a *Report on the Condition of Tropical and Semi-Tropical Fruits in the United States in 1887*, for which fruit-growers and agriculturists the land over will be very grateful, and others interested in such matters can but approve of such an admirable expenditure of the Department's appropriation.

Bulletin No. 1 of the Division of Pomology constitutes the official report of its chief, Mr. H. E. Van Deman, who has been ably seconded in his labors by Mr. P. W. Reasoner of Manatee, Fla., who submits a very full report from that State, and Mr. W. G. Klee, who supplements it by an excellent account of the exotic fruits that have been cultivated in the State of California. As thus submitted, the Bulletin consists of the usual form of government pamphlet, and in the present instance of some hundred and fifty pages, illustrated by three colored plates. With respect to these latter, we are told that "the original paintings, from which the accompanying illustrations were made, are the work of W. H. Prestele, the artist of this Division. They are as nearly exact in size, shape, and color as it was possible to make them from the specimens, and they are in no case exaggerated in any respect." They are reproductions by the lithocaustic process of A. Hoen & Co. of Baltimore, and are to be recommended in many respects, especially in the external aspects of the two Japanese plums, which appear quite natural; while in section the detail of structure seems to us to be a little lacking in points of sharp definition. Plate 1 presents us with figures of the "Kelsey" and "Satsuma," — two Japanese plums, the former now proving a very great acquisition to the fruits of California and Florida, while the latter plum "is another importation from Japan, and is likely to prove valuable. The only tree old enough to bear in America, so far as heard from, is on the grounds of Luther Burbank, at Santa Rosa, Cal. It bore a heavy crop in 1887, and the illustration was made from specimens grown on this tree." The remaining figures of the plates represent specimens of Japanese persimmons, known as the varieties "Yemon," "Hachiya," and "Tane-nashi," all now grown in many parts of the Southern States and California, being delicious fruits, not only rich and pleasant just as they are plucked from the tree, but can be preserved by drying, or be made into marmalades.

Unless one has previously paid especial attention to the subject, he is sure to be surprised upon looking over the list of tropical or semi-tropical fruits that are now successfully grown in the State of Florida; for not only is this list a very long one, but the trees or plants seem to have been brought from nearly all parts of the world. It composes such diverse productions as the pineapple (originally from Havana), the "mammee sapota" (from Central America), the egg-fruit (from Cuba), the strawberry pear (from Jamaica), the pawpaw (from the East and West Indies), the mango, the banana and plantain, the alligator pear, the guava, the tamarind, the almond, the hog-plum, some hundred and fifty varieties of the common orange (*Citrus aurantium*) and many species of its allies, citron, lemons, limes, the

date-palm, the fig. and, indeed, a host of others, far too numerous to even mention here by name. Some of these have flourished well, and handsomely repaid the fruit-grower; others do nicely, and deserve far greater attention than they have thus far received; and all such useful information is abundantly and generously supplied by the bulletin before us.

California has also successfully reared many of the fruits just mentioned, while, in addition, she has done fairly well with the olive and some other semi-tropical trees and plants which are fruit-bearers.

No doubt the Department will take the proper steps to judiciously distribute a certain number of these excellent bulletins among Southern agriculturists and others interested in such matters; and with the therein contained facts, instructions, successes and failures, and suggestions for the future, this bulletin is sure to carry with it a powerful aid and stimulus to this growing industry.

Fort Wingate, N.M., *Aug.* 27, 1888.

ANCIENT HORTICULTURE.

As an art horticulture dates back thousands of years, but as a science it is new. When man ceased his nomadic wanderings, he first gave attention to husbandry, or agriculture proper; but a desire for a greater variety of food induced him to undertake the cultivation of fruits and vegetables The pages of history are full of the accounts of these old gardens, and indicate an advancement truly wonderful for those times. Our first parents were placed in a garden, which they were commanded to dress and keep. The location of the garden is a matter of dispute: Persia, Armenia, Chaldæa, and even Ceylon and Sweden, have all been mentioned as possibly the nursery of the human race. In Ceylon they even point out as the tree which bore the forbidden fruit, *Tabernæmontana alternifolius*, the appearance of the fruit and the odor of the flowers of which are said to be very tempting. The fruit looks as if a piece had been bitten off; and, although it is now poisonous, the tradition is, that it was excellent before Eve ate of it. We are also told that Noah planted a vineyard, and made such progress in the art of grape-growing and wine-making, that he turned out a fine article; but, like many of to-day, he proved his own best customer. If we can believe the accounts that have come down to us in the writings of the earliest profane historians and poets, the gardens of their time must have been possessed of extraordinary beauty. Most of these traditions were undoubtedly mere creations of the fancy, and were only intended to excite wonder in ignorant minds. The Gardens of Hesperides were described as surrounded by steep walls eighteen fathoms high. Among the trees mentioned as growing in them were golden apples (supposed to have been oranges), pomegranates, mulberries, olives, almonds, arbutus, bay, and myrtle. The garden, according to mythology, was inhabited by nymphs, daughters of Hesperus, and was guarded by a dragon which never slept. The eleventh labor of Hercules was to carry off the golden apples. The garden was said to be located in Africa, near Mount Atlas. At first it was thought to be an oasis in the desert, but old stone quarries have been found whose bottoms were covered with rich soil, in which the fruits of the Hesperides were growing. The gardens of Alcinous and Laertes, described by Homer, contained a few fruit-trees and several beds of vegetables and flowers. The garden of Alcinous was surrounded by a hedge, which is the first mentioned in history Cultivating the soil, according to Sir Isaac Newton, was first practised in Egypt. The sacred groves of the Egyptians were watered by meandering streams, which flowed from numerous fountains, and produced an even temperature, thus making a perpetual spring. The sycamore fig was planted in long avenues, and date-palms were very common. The Egyptians of four thousand years ago possessed the grape and various kinds of fruit-trees and numerous vegetables. On the great Pyramid there is said to be an inscription giving the sums paid out for radishes, onions, and garlic consumed by the workmen. Strabo, in his time, describes the country as a delicious garden, through which a traveller might proceed from one end to the other under the shade of all kinds of fruit-trees The Hanging Gardens of Babylon were classed among the wonders of the world. They were said to be square at the base, and covered four acres. The pillars supporting the garden were stone, three hundred feet high, and were so arranged as to form terraces. Stone beams were laid across the tops of the pillars; and these were covered with reeds, on which were double rows of bricks, united with cement, and covered with sheets of lead, which prevented the moisture from passing down. Upon this a thick layer of soil was placed. The upper area and the terraces were covered with trees and flowering plants, interspersed with walks and fountains, seats and banqueting rooms. Water was pumped by machinery from the Euphrates for supplying the fountains and reservoirs. By some the very existence of these gardens is disputed. Quintus Curtius designates them "fabulous wonders of the Greeks." Many think that the garden was merely a hill surrounded with terraces, and planted. Of the Jewish gardens, that of Solomon has received most attention. It was said to be square, and surrounded by a high wall. Solomon wrote: "I planted me vineyards: I made me gardens and orchards, and I planted trees in them of all kinds of fruits: I made me pools of water, to water therewith the wood that bringeth forth trees." The Jews had large vineyards, and grew vines from seed. They seemed to have some idea of the effect of the pollen of one plant upon another, as among the instructions of Moses was the following: "Thou shalt not sow thy vineyard with divers seeds: lest the fruit of thy seed which thou hast sown, and the fruit of thy vineyard, be defiled." So far as their climate allowed, the Greeks copied the gardens of the Persians. The cemeteries of the Greeks, as well as of the Jews and Persians, were public gardens, adorned with fountains and statues. — L. B. Taft, *in Horticultural Times.*

THE FALLACY OF "PLAIN LIVING."

Good plain living is still spoken of by old-fashioned middle-class people as if it consisted of little more than a joint of beef or mutton, roasted or boiled, and as if cookery-books were consequently altogether mistakes; but better-informed people know this is not the case. The prejudice in favor of a joint of meat with a simply made pie or pudding and certain vegetables is, in fact, a fruitful source of indigestion, under the influence of which life loses its enjoyment, and health suffers. Without undertaking any thing costly or elaborate, a variety of admirable dishes may be placed upon the table. Yet, to quote a sound authority, how often do we see, "partly upon the erroneous supposition that plain roast or boiled is the most wholesome species of food, and partly to avoid the trouble of providing any thing else, a whole family, however various their constitutions may be, seated at table before a single joint, to take their chances of suffering from the repletion which even a small portion may occasion to a delicate person, who could have partaken of three or four judiciously cooked dishes without sustaining the slightest inconvenience. The stomach, in fact, never performs its duties so effectually as when it acts upon food composed of much variety." Indeed, the united testimony of high medical authority proves that a variety of well-dressed food is more easy of digestion than a meal confined to one sort of solid meat. As Dr. Herbert Mayo says, "*Diet should be varied.*" And he adds, "A spoonful of soup, a flake of fish, a slice of cold beef, in succession, will often provoke an appetite, and with it digestion, where the nicest cutlet or the most tempting slice of haunch of venison would have gone against the stomach.— *English and French Cookery.*

SELECTED RECIPES.

Chocolate Cakes. — The whites of eight eggs, half a cake of chocolate grated, one pound of sugar, six ounces of flour. Beat the eggs to a stiff froth, add the sugar, then stir in the chocolate and flour. Butter flat tins, and drop the mixture thereon; not too closely, as the cakes will spread. Bake a few minutes in a quick oven.

Royal Cocoanut Tarts. — Half a pound of granulated cocoanut and a quarter of a pound of powdered sugar. Mix these with the yolks of ten eggs and a little milk, then add four stale sponge-cakes rubbed fine and sifted; mix well together; flavor with essence of lemon. Line some patty-pans with puff paste rolled thin, and put some of the mixture in the centre, then sift over the mixture some desiccated cocoanut.

Caramel Fruit. — Take one pound of loaf sugar, break it up small, put into a pan, and pour over it one pint of water; put it on the fire, and let it boil to crack, or 310°. Have ready some different kinds of fruit, such as three cherries in a bunch, one green-gage, three grapes, a large bunch of red currants, two damsons, a section of an orange, one-eighth of an apple, three raspberries tied together, two strawberries, half an apricot, or any other fruit in season; mind that they are all perfectly dry. Have a tin plate oiled or buttered, and, as you dip the fruit into the caramel, place on this tin, the best side upwards.

Cooked Celery. — Celery has long been used for salads or eaten raw, but it is very much better cooked; indeed, it thus becomes one of the most appetizing dishes prepared for our table. Cut it in small cross-sections, using nearly the entire stalk and roots, rejecting only the very green parts. Cook it in but little water, so that when very tender the water will have boiled nearly away; then add milk sufficient for a nice gravy; season to taste with salt and pepper; rub butter and flour to a smooth paste, and add sufficient to make it of a creamy consistency. When the flour is scalded, it is done.

Tomato Omelets. — Ingredients required, one pound tomatoes, one pound bread-crumbs, a very large Spanish onion, three eggs, twenty ounces of butter, cayenne and salt to taste. Melt the butter in a saucepan; add the onion chopped small with a little cayenne and salt (no water); let it cook for twenty minutes before adding the tomatoes, stirring occasionally, but not keeping the saucepan-lid off longer than is necessary. Scald and skin the tomatoes, cut them into small pieces, add to the onion, and let all simmer together for about half an hour; pour the whole over the bread-crumbs in a large basin, mix together, then add the eggs well beaten, and turn into a shallow tin or tins previously well buttered. Bake in a quick oven for about ten minutes.

The Popular Science News.

BOSTON, NOV. 1, 1888.

AUSTIN P. NICHOLS, S.B. . . . . *Editor*
WILLIAM J. ROLFE, LITT.D. . . . . *Associate Editor*

Those wishing to subscribe for other periodicals in connection with the POPULAR SCIENCE NEWS *are recommended to examine the "Clubbing List for 1889," which will be found in the advertising columns. Several changes in the prices since the last season should be especially noted.*

In the sad death of Professor Proctor, the well-known astronomer and lecturer, the scientific world has met with a serious loss. He was a prolific writer on astronomical subjects, as well as in other departments of science, and attained his widespread reputation more from his power of popularizing scientific principles and theories than from any great superiority of knowledge or skill in his profession. While he was not, strictly speaking, a great astronomer, he was a scientist of unusual attainments, and did valuable work in rendering the public familiar with the results of the researches of others. He was formerly a member of the Roman-Catholic Church, but in 1875 severed his connection, believing that his scientific views were incompatible with loyalty to that faith.

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The criticisms by certain papers of the poor judgment shown by the New York Board of Health in removing Professor Proctor to a hospital at the crisis of his disease, and during a heavy rain-storm, may not have been justified by the facts in the case, but it serves to call to mind the blighting influence which "practical politics" exert, even upon those branches of science which meet with the recognition of the government. This is especially evident in certain of our exchanges which purport to be devoted to sanitary matters, but are really principally concerned with the politics of innumerable "Boards," "Bureaus," and "Associations." The State has hitherto signally failed in its numerous attempts to make men "wealthy and wise" by legislation, and we do not believe that the influence exerted by the average politician can be "healthy" in any sense. It is to the independent original investigators that our advances in sanitary science are due, and not to official "inspectors" or organizations of "licensed" plumbers.

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The almost universal acceptance of the doctrine of evolution by the scientists who took part in the meeting of the American Association at Cleveland was a matter of considerable comment among those who were unaware of the recent progress of scientific thought. The time has passed when the Darwinian theory was supposed to imply that men were descended from monkeys, — an idea never held by Darwin or any other naturalist, — and the great principle that existing forms of life have arisen by variation and development from simpler forms of organized beings previously existing, is coming more and more into favor, and, in fact, now forms the foundation-stone of all biological investigations. A complete and satisfactory system of evolutionary philosophy is yet to be formulated, and the different theories advanced must themselves be subject to natural selection and the law of the survival of the fittest; but the fundamental ideas first advanced by Darwin, Wallace, and Lamarck were never more generally accepted by naturalists than at the present time.

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The tendency towards specialism and subdivision in the different branches of science is also noticeable. Scientific investigators seem to be inclined to limit their field of research. The archæologist hesitates to enter upon the field of the geologist, and the line between physics and chemistry is constantly becoming more sharply defined. It is a question whether this tendency is a beneficial one. It gives better opportunity for thorough work in a limited field, but the advantages of a broad, comprehensive view of the subject are entirely lost. The most important scientific discoveries have heretofore been made by those having a general scientific habit of thought rather than by those devoting their entire energies to the elucidation of a single disputed point. In any case, the cultivation of specialties is certainly on the increase, and time will show whether the effect will be advantageous or not.

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The universal language, Volapük, is slowly coming into use, but so slowly that some doubt remains whether it will ever be universally adopted. It has certainly met with more favor than any similar scheme heretofore proposed, and seems to be, on the whole, well adapted to its purpose. The study of such an artificial language is, in any case, an excellent mental discipline, and will undoubtedly be of more or less practical value to those who have made themselves familiar with it. As we go to press, the death of its inventor, Johann Martin Schleyer, is announced.

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The *Philadelphia Medical and Surgical Reporter* has recently commenced a good work in entering upon a crusade against those religious newspapers who admit to their columns the advertisements of quack doctors and quack medicines. The evil is a widespread one, and we know of but one religious paper in this city which refuses such advertisements. As has often been stated in the *Science News*, the innumerable cure-all nostrums so extensively advertised are either entirely worthless or actually injurious, while every doctor who advertises his practice or his cures may safely be set down as an unmitigated quack, unworthy of the slightest confidence. An enormous amount of harm, both physical and moral, is accomplished by the numerous scoundrelly ignoramuses advertising themselves as physicians, and it is highly inconsistent with the principles of a religious journal to aid in bringing such persons or pretended medicines into public notice. We hope our contemporary will persevere in its good work, but fear it has an almost hopeless task before it.

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We have received from a German manufacturing firm a catalogue of the oils and essences prepared by them for the purpose of making artificially all kinds of liquors and cordials, without the intervention of the fermenting tub or the still. Nearly two hundred recipes are given for compounding different liquors and "mixed drinks" from alcohol and these essential oils. The manufacturers *naïvely* remark in their circular, that "the method of manufacturing brandy and liquors by mixing carefully prepared essential oils and essences with spirit and the other fundamental ingredients, instead of resorting to the antiquated process of direct distillation, is now generally admitted to be most advantageous." We think, however, that if any "advantage" is to be obtained from spirituous liquors, it will certainly not arise from the use of these villanous mixtures, and should prefer the "antiquated process of direct distil ation." To make their circular complete, the manufacturers should have added a prescription for the cure of delirium tremens.

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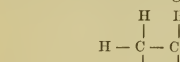
ORGANIC CHEMISTRY.

Chemistry is divided into two great departments, — the organic and the inorganic. The organic substances were formerly but little studied, and the best work of the earlier chemists was devoted to investigations upon the metals, metalloids, and other elements and compounds which were not dependent for their existence upon the action of living organisms, as was formerly supposed.

In 1828, however, Wohler succeeded in forming the well-known excretory product of the animal organism, urea, from iso-cyanate of ammonia, a strictly inorganic salt. This brilliant result called the attention of chemists to this class of substances; and at the present day, organic chemistry, or the chemistry of the compounds of carbon, receives a large share of the attention of investigators, somewhat to the neglect of the equally interesting and important inorganic compounds. A reaction seems to be taking place of late years, however, as is shown by the extended investigations of Dr. Gibbs upon complex inorganic molecules, of Dr. Crookes upon the nature of the elements, and of Professor Cooke and many other chemists upon the atomic weights.

Organic compounds are those made up of a skeleton of carbon atoms to which are joined atoms of hydrogen, oxygen, nitrogen, and, more rarely, other elements. For a familiar example, we may take common alcohol, the symbol of which is C_2H_6O. Extending this

into a structural formula, showing how the atoms are united among themselves, we have

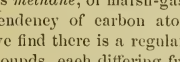


which shows the foundation or skeleton of two carbon atoms, with their chemical affinities, satisfied by the addition of five atoms of hydrogen and one of hydroxyl (OH).

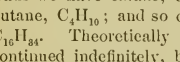
It is a peculiar tendency of carbon atoms to unite among themselves in an endless variety of ways. Carbon has four valences, or chemical affinities, and can unite with four atoms of hydrogen or other element having only one valence. The simplest hydrocarbon, therefore, has the composition CH_4, and is known as *methane*, or marsh-gas. But, owing to this tendency of carbon atoms to unite together, we find there is a regular series of such compounds, each differing from the other by CH_2. Thus we have *ethane*, C_2H_6; propane, C_3H_8; butane, C_4H_{10}; and so on up to hexadecane, $C_{16}H_{34}$. Theoretically the series might be continued indefinitely, but only a few of the higher members are actually known.

Several other series are known, dependent upon the different number of valences or affinities of the carbon atoms which are neutralized by uniting with each other; and, as each of the members of these series can be changed in a great variety of ways by the addition or substitution of other elements and compound radicals, it will be seen that the number of possible organic compounds is almost infinite, and increases at the same rate as the numbers in problems of permutation. Starting with the skeleton of carbon atoms, we can form or build up different individual organic substances, just as the different human individuals are all supported by a similar bony framework.

But there is still another and greater cause for variety in organic substances. This is isomerism, or the occurrence of two or more bodies, different in every respect, but possessing the same chemical composition. A simple example is fouud in two substances known as butyric acid and acetic ether, both having the symbol $C_4H_8O_2$, but with their atoms arranged in very different order, as shown by the following structural formulæ: —



Butyric acid $= C_4H_8O_2$.



Acetic ether $= C_4H_8O_2$.

According to this theory of *position* the different compounds are built up from the same elements, just as different buildings may be formed out of the same bricks. Of course, this is only a theory, as we cannot actually prove the existence of the atoms themselves, to say nothing of their position in the molecule; but the theory perfectly explains all the observed facts, and evidently is based upon some great natural law, although it may be an entirely different one from that which we conceive it to be at present. The artificial production of alizarin, or the coloring principle of madder, is a triumph of this theory, as it was due entirely to considerations based upon this theory of position. The working-out of these structural formulæ, as they are called, is engaging the attention of the majority of chemists at the present day.

Of the millions of possible organic bodies, only comparatively few have ever been actually produced. The majority of them are of no practical value, although, on the contrary, some of the most important and useful substances known are included in this class. Albumen, gelatine, starch, woody fibre, sugar, morphine, quinine, indigo, and the aniline colors, all possess the nucleus of carbon atoms. This peculiar element, which is so closely connected with the products of living beings, forms, when combined with oxygen, only the dead, inactive carbonic dioxide, or, when united to nitrogen, becomes a part of the highly poisonous derivatives of cyanogen, the radical of the deadly prussic acid. No other element exhibits itself in so many different forms, and none confers its own inherent characteristics upon its compounds to a less degree. We have yet much to learn about the true nature of the carbon compounds; and until this knowledge is obtained, we must rest content to explain the singular phenomena presented by these bodies, by an unproved and perhaps unprovable theory.

[Specially reported for *The Popular Science News.*]

METEOROLOGY FOR SEPTEMBER, 1888.

TEMPERATURE.

AVERAGE THERMOMETER.	Lowest.	Highest.	Range.
At 7 A.M.	55.70°	84°	70°	36°
At 2 P.M.	64 87°	53°	76°	23°
At 9 P.M.	56.57°	38°	69°	31°
Whole month	59.04°	34°	76°	42°
Last eighteen Septs. . .	61.29°	57.36°, in 1887.	66.69°, in 1881.	9.33°

The lowest point of the thermometer the last month at the hour of observation was 34°, on the 30th; the highest 76°, on the 10th. The coolest day averaged 41⅔°, also the 30th; the warmest, 70⅔°, the 17th, only one-third of a degree warmer than the 1st. The entire month was two and a quarter degrees cooler than the average of the last eighteen Septembers, and the coolest, with three exceptions. The last ten days of the mouth averaged only 52 37°, and embraced a long period of cool, cloudy, and uncomfortable weather. This cool month has increased the general backwardness of the year, showing the daily temperatures thus far to be 1 16° below the average. This deficiency of heat must have had a sensible influence on vegetation. The first frost of the season occurred on the 7th, very slight in this immediate locality. More severe frosts occurred on the mornings of the 29th and 30th.

SKY.

The face of the sky in 90 observations gave 37 fair, 15 cloudy, 28 overcast, and 10 rainy, — a percentage of only 41 1 fair. The average for the last eighteen Septembers has been 59.2 fair, with extremes of 35.5, in 1882, and 77.7, in 1871. This has been the cloudiest month, with a single exception, in eighteen Septembers. Nearly one-third of the month was completely overcast, not including the ten rainy observations. The sun was a comparative stranger for quite a period toward the end of the month. The 26th was noted as a dark day. The morning was so dark till 10 A.M., it was necessary to have a light in order to read or write with comfort, while the rain was falling in torrents, and the wind blowing fiercely from the north. The mornings of the 20th and 25th were foggy, and but very few days could be called fine. The 2d, 3d, and 27th only were so noted.

PRECIPITATION.

The amount of rainfall the past month was 9.88 inches, the largest amount in September for twenty years. The next largest amount in September was 9 30 inches, in 1882, when we had 14 rainy observations. The average amount in September for twenty years is only 2.86 inches, with extremes of .45 inch, in 1877, and 9 88, in 1888. The largest amount at one time the past month was 3.44 inches, on the 26th, with a strong wind. This large amount fell in a few hours during that dark morning. On the 10th, 18th, and 21st were heavy rains, — a total fall of 4 55 inches, in nearly equal amounts. Sharp lightning and heavy thunder occurred on the 21st. The amount of precipitation since Jan. 1 has been 46 27 inches, while the average for these nine months the last twenty years has been only 34 53, showing an excess of 11.74 inches above the general average.

PRESSURE.

The average pressure was 30 033 inches, with extremes of 29.60, on the 26th, and 30.50, on the 7th, — a range of .90 inch. The average for the last fifteen Septembers has been 30.025 inches, with extremes of 29 915, in 1876, and 30.110, in 1887. The sum of the daily variations was 4.40 inches, giving an average daily movement of .147 inch. This average in fifteen Septembers has been .128 inch, with extremes of .074 and 166. The largest daily movements were .51, on the 26th, .45, on the 8th, and .28, on the 10th, all on days of heavy rainfall; and yet the heavy rain of 1.54 inches on the 21st was attended by only .08 inch movement, while on the three preceding days, and the day following, the barometer was stationary. The month maintains its claim as the banner month for the highest average barometer. It was 30 inches or above for eighteen days.

WINDS.

The direction of the wind in 90 observations gave 18 N., 5 S., 13 E., 11 W., 11 N.E., 19 N.W., 4 S.E., and 9 S.W., an excess of 30 northerly aud 11 westerly over the southerly and easterly, and indicating the average direction of the month to have been W. 69° 52′ N. The westerly winds have uniformly prevailed over the easterly in September, with a single exception for nineteen years, by an average of 25.47 observations, and the northerly over the southerly, with eight exceptions, by an average of 1.90; indicating the approximate average direction the last nineteen Septembers to have been W. 4° 15′ N. This shows that the winds the past month have been 65° 37′ more northerly than usual, and one cause of the unusually cool month. The relative progressive distance travelled by the winds the past month was 31.95 units, and during the last nineteen Septembers 485 3 such units, — an average of 25.54 per month; showing less opposing winds than usual.

IN REVIEW.

It may be said the past month was very unusually cool, cloudy, and rainy, with excessive northerly and easterly winds, but medium pressure. Such a remarkable combination of extremes gave us a large amount of disagreeable, uncomfortable weather, unfavorable to many crops and to vegetation in general, not to mention also the public health and spirits.

D. W.

Natick, *Oct.* 5, 1888.

[Specially computed for *The Popular Science News.*]

ASTRONOMICAL PHENOMENA FOR NOVEMBER, 1888.

The Planets. — Mercury is a morning star, and comes to its greatest western elongation on the morning of Nov. 17, when it rises about 1*h.* 20*m.* before the Sun. It may probably be seen for a few days before and after that time in the early morning twilight. Venus is an evening star, and is slowly approaching its eastern elongation. At the beginning of the month it sets about two hours, and at the end of the month about two hours and a half, after the Sun. Mars is still an evening star, but is slowly approaching the Sun. It sets at about half-past eight. It is in the constellation Sagittarius, and is moving eastward toward Capricorn. Jupiter sets at about 7 P.M. at the beginning of the month, and a little after 5 P.M. at the end of the month. It is getting so close to the Sun, that it can be seen only during the first part of the month. It will hardly be possible to see any of the eclipses of his satellites during the month, as the planet is too near the Sun, and sets too early. Saturn rises at about midnight on Nov. 1, and at 10 P.M. on Nov. 30. It is in quadrature with the Sun on Nov. 11. It moves slowly eastward during the month, and at the end becomes stationary preparatory to beginning its retrograde motion. It is about 8° west of the first-magnitude star Regulus (*Alpha* Leonis). Uranus is a morning star, rising at about 2*h* 30*m.* A.M. on Nov. 30. It is then nearly due north of Spica (*Alpha* Virginis) about 4°. Neptune comes to opposition with the Sun on Nov. 22. It is about 5° south of the Pleiades.

The Constellations. — The positions given hold good for latitudes differing not many degrees from 40° north, and for 10, 9, and 8 P.M. for the beginning, middle, and end of the month respectively.

Andromeda is in the zenith. Pisces is to the south, high up. Cetus is just coming to the meridian, low down. Aries is in the south-east, at about 60° altitude. Taurus follows Aries, a little south of east, at about 40° altitude. Orion has just risen in the east. Perseus is high up, a little north of east. Auriga is below Perseus; and Gemini is on the horizon, a little north of east. Ursa Major is below the pole star; and Cassiopeia is above, toward the zenith. To the left of the pole star are Cepheus above and Ursa Minor below. Cygnus is about halfway up, a little north of west; and Lyra is below it. Hercules is setting on the north-west horizon. Aquila is low down near the north-west horizon. Pegasus is south-west of the zenith, high up; and Aquarius and Capricornus are below it, the latter being just above the south-west horizon. Piscis Australis is low down, a little west of south.

M.

A STILL body of water at a temperature of from 75° to 80°, which is about the ordinary summer temperature, will evaporate about three-eighths of an inch in twenty-four hours if there is no wind. With the wind blowing at twenty miles an hour, the evaporation will be about half an inch.

Correspondence.

Brief communications upon subjects of scientific interest will be welcomed from any quarter. The editors do not necessarily indorse all views and statements presented by their correspondents.

BOWLDER ROCKS.

Editors Popular Science News:

The article in your September issue on the subject of bowlders, and especially of a large one still in motion on the glacier in Switzerland, prompts me to send you a brief and imperfect description of some travelled rocks in this vicinity.

Washington Bowlder, situated a mile or more from this village, has always been called the largest in the world. Its dimensions are, roughly, 63 by 45 by 38 feet, estimated to contain 107,730 cubic feet.

The rock is practically altogether above the surface of the ground, rests upon an acute angle or point of its contour, making it look as if it could easily be pushed over, and is surrounded by large and small blocks of stone which have apparently fallen from its sides through the action of frost and other natural agencies.

Within a few years a still larger bowlder has been discovered about four miles in another direction, called Clark's Bowlder, from the name of the man who first brought it to notice. This bowlder is about the same in height as the other, but much larger in other dimensions, making it upwards of 300 feet in circumference. One side of Clark's Bowlder is nearly perpendicular, and almost as flat and regular as the side of a house. This side is about 38 feet in height and 75 feet in length. This rock is shown to be a "traveller" from the fact that it does not resemble in structure the surrounding ledges, and from the perfect polish it has received on many of its surfaces from attrition of other rocks as it was pushed along from its original matrix to its present resting-place. The human mind becomes bewildered in its attempt to grasp the idea of the vast force required to wrench this immense rock from its bed, and transport it many miles over hill and valley. It would seem to be desirable, and perhaps of value to science, that some man interested in the subject of glacial action, and sufficiently well informed to make a satisfactory report, should make a thorough examination of these bowlders, and place the results on record; especially as the Clark Bowlder has been sold to quarry men and is sooner or later to be broken up. I should be happy to give such aid as I can to such an investigation.

Very truly yours,

S. A. Evans, M.D.

Conway, N.H., *Aug.* 31.

QUESTIONS AND ANSWERS.

Letters of inquiry should enclose a two-cent stamp, as well as the name and address of the writer, which will not be published.

Questions regarding the treatment of diseases cannot be answered in this column.

E. M. W., *California.* — How much hydrochloric-acid gas by weight is there in one liter of liquid hydrochloric acid of 1.20 specific gravity?

Answer. — The liquid acid at 1.20 contains 40.80 per cent of HCl. As a liter of this acid weighs 1,200 grams, it contains 489.6 grams of the pure hydrochloric-acid gas. A liter of the liquid acid entirely saturated with the gas would have the specific gravity 1.21, and contain 42.85 per cent, or 518.4 grams, of the gas.

C. E. B., *Hartford,* writes that the figures in the table on p. 150 of the October number represent the number of gallons for every *ten inches* in depth, instead of every foot, as stated.

H. N. E., *Buffalo.*—Why do we always see the same face of the moon turned towards us?

Answer. — As the moon revolves around the earth, it also makes just one revolution on its axis, thus keeping the same side always towards the earth. You can easily illustrate this by placing an orange in the centre of a table to represent the earth, and moving another one around the edge of the table. You will find, that, if you keep the same side always opposite the central sphere, the moving one will turn once on its own axis in making the journey around the table. (2) Mercury and Venus show different phases, like the moon. Those of Venus can easily be observed with a small telescope or spy-glass.

B. S. C., *Wisconsin.* — How does chloride of lime (bleaching powder) differ from chloride of calcium, or are they the same substance?

Answer. — Chloride of lime is, chemically speaking, a misnomer. Bleaching powder is really an impure hypochlorite of calcium, $Ca\,Cl_2O_2$, while chloride of calcium has the composition indicated by its name, $Ca\,Cl_2$.

G. B. A., *Minnesota.* — Is the vacuum in the incandescent electric lamps a perfect one?

Answer. — A perfect vacuum has never been produced; and although the vacuum in the lamps is almost perfect, it is not quite so, and contains an appreciable quantity of air — probably many trillions of molecules. The space above the mercury in a barometer is the most perfect vacuum ever produced, but even that contains a small quantity of vapor of mercury.

E. C. K., *New York.* — Butter of antimony is antimonious chloride, $Sb\,Cl_3$. It is very deliquescent, and quickly absorbs water, forming a soft, greasy substance, whence its name.

LITERARY NOTES.

Inductive Language Lessons and Elementary Grammar. By Harris R. Greene, A.M. A. Lovell & Co., New York, publishers. Price 54 cents.

This excellent text-book is written on a very different plan from the old-fashioned works upon grammar and composition. It is the result of the author's experience of twenty years in the study and teaching of English, and is well adapted to give to the pupil a clear conception of the form and composition of language. Teachers and school superintendents will do well to examine it.

The same firm publish a *Note-Book of Astronomy,* by Marion L. Perneike, M.D. (40 cents). It gives a condensed but complete statement of the chief facts of descriptive astronomy, with interleaved blank pages for the diagrams and notes of the student himself.

Researches on Diamagnetism and Magne-crystallic Action, including Diamagnetic Polarity. By Professor John Tyndall. D. Appleton & Co., New York.

This work treats of a most interesting and important subject, and one which has not been very generally studied. It is based upon some of the earliest researches of the author, which were suggested by the well-known experiments of Faraday. The work will be of the greatest value to students of electricity and magnetism, and all such should give it a perusal.

The Modern Treatment of Diseases of the Liver, by Professor Dujardin-Beaumetz of Paris, has been translated by Dr E. P. Hurd of Newburyport, Mass., and published by George S. Davis of Detroit, Mich., at 25 cents in paper, and 50 cents in cloth. The author is well known as an eminent physician and a leader in therapeutics, and the low price at which his work is published renders it available to every physician.

Dr. David Starr Jordan, president of the University of Indiana, has written a *Brief Account of the Darwinian Theory,* which is published by A. B. Gehman & Co. of Chicago at 25 cents. This essay is written in a simple, popular style, and should be read by every one who desires to know what "Darwinism" really is, and to obtain a clear understanding of this much-abused theory.

The Proceedings of the Society of Arts of the Massachusetts Institute of Technology for the year 1887–88 contains, as usual, a large number of scientific papers of the highest value and importance. Copies can be obtained of the secretary of the society at Boston.

Pamphlets, etc, received: *Notes on the Literature of Explosives,* by Professor Charles E. Munroe, Government Torpedo Station, Newport, R.I.; *Dying at the Top,* by Rev. J. W. Clokey, D.D., New Albany, Ind. (10 cents); *Our Bandanna,* Rand Avery Company, Boston; and the *Reports of the United States Commissioner of Pensions,* and *the Division of Forestry of the Agricultural Department.*

Medicine and Pharmacy.

[Original in *The Popular Science News.*]

THE OPIUM HABIT.

BY JOHN CROWELL, M.D.

AMONG all the therapeutical agents used in the treatment of disease, none is more potent and more reliable than opium; and because of its reliability it is often called the "sheet anchor" of medicines. But, like alcohol, this potent drug has been the means, by its misuse among the weak and thoughtless, of bringing moral degradation both to the individual and to an entire nation. So great has become this evil, that the thought of the scientist and the philanthropist has been awakened, and methods have been suggested for arresting the spread of the physical and moral results of the dreadful habit. It is really a disease of modern times; for, although the drug was used by the ancients, we have no mention of the excesses of the present day. Allusions to opium are made by the classical writers, and Homer, Ovid, Pliny, and Virgil make mention of its use, and Hippocrates and Galen considered it of importance. But nowhere among the ancient writings which have come down to us, nor among the inscriptions found in Egyptian ruins, do we find any evidence of its use as a stimulant or intoxicant, such as we see in our own times. The first we hear of the drug in India is in 1511, and in 1644 it was carried into China by some of the Tartar tribes. But the people of both countries were slow in acquiring a fondness for it, especially in India.

In 1767, however, a Mr. Watson suggested to the East India Company the idea of shipping opium into China; and, following this suggestion, the abundant introduction of the drug into that country proved to be the deadly scourge which has so afflicted and degraded that unfortunate people. All efforts to suppress the growing evil have proved abortive; and in 1860 the English, by the menace of cannon, forced the Chinese to legalize the nefarious traffic, and now the vice of opium-eating and opium-smoking has become national. Calkins says that "Hindostan has become the great poppy garden, and India the great opium market, of the world." In our own country the opium habit has been developing for about forty years. In 1843 Dr. Wood of Edinburgh introduced the hypodermic method of injecting the narcotic; but before this, either the gum was used in its crude state or in the form of some of the alcoholic preparations. Since the use of the hypodermic syringe the consumption of opium has enormously increased, both in this country and in Europe. The use of the drug in this form, and its quick diffusion through the system, act like a charm to the victim, and the resort that is made to this process for the petty ills and pains of the system is alarming by its frequency and by its results.

Among Eastern nations smoking has been the favorite method of using opium as a sensuous habit. The effect of opium-smoking upon the people of the Orient is quite different from that produced in the temperate zone. The habit was brought into this country by the Chinese; and, according to Kane, the first American to indulge in the pipe was a low fellow in California, who in 1868 induced his associates to try its stimulant effects: and, as a result, in the space of a few years opium-smoking became so general upon the Pacific coast, that the authorities interfered to prevent its debasing tendencies. Opium-smoking, however, is chiefly confined to the large cities, and is found among people of Oriental habits. It is generally carried on by Chinese proprietors, who in the most subtle way manage their subterranean establishments. Smokers consume about six grains of the drug at first, and increase the amount from day to day, until three hundred grains are used daily.

Habitual use of the drug causes a more or less imperative demand for a repetition of the dose as the effect begins to wear off. As the time draws nigh, the victim begins to feel somewhat nervous and uneasy; sometimes he is chilly, with a habit of yawning and stretching, and oftentimes he may suffer neuralgic pains in different parts of the body. If the administration is not at once made, the victim experiences nausea and profuse perspiration, with a sense of extreme prostration and fatigue. But all these distressing sensations vanish when the dose is taken. After a while it is found that an increase of the drug is necessary in order to produce the desired results, and before long an amount is tolerated of surprising magnitude.

Opium-eaters take the drug in every variety of form. In the crude state the gum is eaten or smoked. In the liquid preparations the tincture is the most popular; but paregoric is a favorite form, especially with women, while the elixirs are also largely used. Morphia holds sway over a large proportion of consumers, either by the stomach or hypodermically. The amount of the sulphate of morphia that can be tolerated by a confirmed subject is enormous, sometimes reaching as high as sixty grains in twenty-four hours.

The organ most directly affected is the stomach, and nausea and impaired digestion, and consequent lack of nutrition, are among the results that follow. This imperfect action of the stomach shows its effects in the impaired condition of the intestinal canal, and the depressing condition of a faulty assimilation of the food. The red corpuscles diminish in number, the skin becomes sallow, the muscular system flabby, and the power of endurance is greatly diminished. Obstinate constipation follows, caused by paralysis of the intestinal glands; and this condition is often so severe as to render the action of the bowels almost impossible. The action upon other organs is more or less potent; especially are the kidneys affected, and albuminaria has been traced to the use of the drug in the subcutaneous injection.

But it is upon the nervous system that the use of opium produces the most profound results. It is here that the pathological effect is clearly seen, the influence upon the secretory glands being merely secondary. This action extends to the highest nerve-centres in the brain, and often the mental and moral faculties are disturbed by a prolonged use of the drug. Every physician has seen in opium *habitués* cases illustrating, to a greater or less extent, the stimulant action upon the intellectual centres. While under the influence of the drug, there is seen the vivacity, the loquacity, the brilliant flash of the eye, the ardor and glow of the countenance, and the general super-excitation so peculiar to the morbid condition, and in such contrast to the depression and wretched melancholy attending a deprivation of the drug.

There are cases of society women who, having spent most of the day in bed, will flash most brilliantly in the evening under the influence of the drug. And the fascination of literary and æsthetic conversation, so captivating to the *habitués* of *salons*, is not unfrequently the inspiration of the potent stimulant.

When the habit is given up, the mind usually is restored to its normal activity; but when indulged in for years, opium may produce a permanent enervation of the mental and moral faculties, and this deterioration is no doubt due to an organic degeneration of the cerebral centres.

The question of the moral and legal responsibility of the opium-eater is an interesting one. The same rules would apply here as in the case of the victim of alcoholism. A case is recorded by Obersteiner, in 1880, of a young man who attempted to evade punishment for theft by reason of his being an opium-eater, or morphinist. His plea was, that, on account of his habit, "his cerebral blood-vessels were so congested that his ideas of things were perverted." The plea did not prevail, and he was unable to prove that he was addicted to the habit. The case illustrates the danger of extenuating crime committed by persons while under the influence of a degrading habit.

In the treatment of this morbid condition two methods are tried, — a sudden withdrawal of the use of the drug, or a gradual diminution in its administration. Both methods have strong advocates; among the former, Levinstein is a strong adherent of the sudden and total cessation of its use, and he sustains his position by ingenious and able argument and illustration.

But this theory and practice are sharply controverted by the wisdom and experience of the managers of retreats for the victims of this dreadful habit. According to Dr. Bancroft of the Concord, N.H., Asylum, gradual reduction is generally approved by physicians in this country. The change can often be made with a good deal of success up to a certain point. Thus, Dr. Bancroft reports a case where twenty-seven grains of morphine *per diem* were brought down to nine grains in three days. After this point the reduction was slower, and sometimes the use is held to the fraction of a grain for a long time. Of course, the will of the patient must be enlisted in the process, as far as is possible; and hence hospital treatment is the best, where the oversight can be constant and severe. Bartholow, in his work on hypodermatic medication, recommends the use of atropine with the morphine; increasing the former, while the latter is diminished. By this process he contends that the terrible sufferings caused by the abolition of the final doses are materially lessened.

[Specially compiled for *The Popular Science News.*]

MONTHLY SUMMARY OF MEDICAL PROGRESS.

BY W. S. WELLS, M.D.

SUCCESSFUL transplantation of skin from a corpse to a living patient is reported by Dr. Bartens in the *Berliner Klinische Woch.* The patient was a boy aged fourteen, who was suffering from a loss of the integuments of both feet, consequent upon a burn. Some skin was taken from the legs of a man aged seventy-five, who had died twenty minutes before, and was transplanted to the boy's feet. Cicatrization of the ulcers promptly followed.

DR STEPHEN SMITH of New York is reminded by the above (*Medical Record*) that several years ago he transplanted seventy-five particles of skin from a leg that had been amputated over two hours, and of this number seventy-three lived, and grew vigorously.

M. BARIÉ (*London Lancet*) has observed four cases of variolous periostitis. The bones most frequently attacked were the left tibia, the radius, and the humerus. The periostitis generally appeared five or six weeks after the onset of the smallpox, and manifested itself first by severe pain, limited to one part of the skeleton. There was no redness or heat of skin; a sort of swelling or hard œdema being found over the seat of pain, but no fluctuation. It was supposed to be identical, pathologically, with the periostitis supervening in typhoid-fever.

A case of partial sloughing of the cornea, due to exposure to cold for nine hours on a Russian steppe, in driving against a snow-storm, is reported by Dr. Kuritzin (*Lancet*). Both eyes were similarly affected, somewhat deep ulcers having formed, in shape and position corresponding to the openings between the eyelids. The other parts of the eyes were scarcely affected. The patient had never previously suffered from any affection of the eyes, and made a good recovery.

The Sydney Board of Health having requested Dr. W. Peirce, of the Coast Hospital, to report upon his treatment of typhoid-fever, — the rate of mortality having been remarkably low, — Dr. Peirce states (*London Lancet*) that, in cases received within the first ten days of the disease, calomel (three to five grains) is administered, and after that acetanilide, in five-grain doses, whenever the temperature exceeds a certain point (101° to 103°), up to six or eight times in the twenty-four hours. The effect of this is to cause a fall of temperature in about forty minutes, attaining its minimum in from two to four hours, with lowering of the pulse and respiration rates, and with decrease of arterial tension, and profuse sweating.

The tendency to delirium is diminished, and there follows a sense of repose. When the effect of the drug passes off, the temperature often rises with great rapidity, and the dose must be repeated.

Dr. Peirce considers this treatment to have advantages over cold bathing. The drug may be given for several weeks; and he has not found it contra-indicated, even when there were cardiac complications. In all cases where it is *freely* given, there is liability to occasioual cyanosis of extremities and face, with irregular pulse.

Alcohol was sparingly given, and generally only in cases of failing heart.

The Board of Health complimented Dr. Peirce on the favorable results of his treatment.

Dr. Huchard reports that salicylate of magnesium has rendered him wonderful services in the treatment of typhoid-fever. The ataxic symptoms disappeared, the fetor of the breath vanished, the distended abdomen was diminished in size, and the foul odor of the stools was banished.

He believes that the death-rate from ileo-typhus can be greatly lessened by the employment of salicylate of magnesium. The dose may be fixed at ten to fifteen grains, three times daily. It is soluble in water, also in alcohol.

Dr. R. Sanderson, at the Brighton and Sussex Medico-Chirurgical Society (*British Medical Journal*), read a paper on diphtheria, according to which the local lesion should be regarded, bacteriologically, as a "cultivation" upon human mucous membrane, and that the constitutional poisoning was directly proportional to the area occupied by the cultivation.

The diphtheritic membranes were a protecting blanket under which, and in which, this cultivation throve, and, moreover, were in themselves a mechanical danger, aud aided the spread of the cultivation by transplantation and continuity.

They should therefore be thoroughly dissolved early, and re-dissolved as soon as re-formed.

He knew of no solvent better than Finkler's papain. Having exposed the cultivatiou, a germicide should be used; he preferred acid carbolic, ʒi.; glycerine, ʒi. — M.

He maintained that by taking a case early, and treating the local lesion as above indicated, the area, and consequently the toxæmia, could be controlled, and the danger of invasion of the nose and larynx minimized.

A novel treatment of hydrocephalus in infants is published by Dr. Somma (*Deutsche Zeitung*), who has availed himself of the heat of the sun in curing five cases of this disease in its chronic stage. The treatment is as follows: —

The child is given to an assistant, whose head is covered. With a clear sky, the occiput of the child is exposed to the rays of the sun, — the assistant seated and immovable.

In the first four or five days the exposure may last a half-hour or less; later, forty or fifty minutes. The treatment must be continued for a month. Dr. Somma believes the action of the heat of the sun produces absorption of the collection of intra-cranial serum, and gives a healthy stimulus to the vaso-motor system.

Dr. Little (*Dublin Journal Medical Science*) states that migranous headache is best relieved by twenty grains of salicylate of sodium in a wineglassful of water, made effervescent by the addition of a dessertspoonful of effervescent granular citrate of caffeine. The doctor has not found the latter alone efficient.

For the expulsion of tape-worm, with its head, Professor Pepper of Philadelphia successfully employed the following procedure: The patient fasted during the day, and took a saline purge in the evening. The next day two fluid drachms of oleo-resin of male fern was given, rubbed up with sugar, at 7 A.M., 8 A.M., and 10 A.M.

With the last dose a saline purge was given.

He says it is useless to trifle with smaller doses of male fern.

For the immediate relief of cramps in the legs, Dr. St. Clair (*Medical Age*) winds a coil of string around the leg over the place that is cramped, and, taking an end in each hand, gives it a sharp pull, one that will decidedly hurt. Instantly, he claims, the cramp will let up, and the sufferer may rest assured the cramp will not come on again that night. For a permanent cure he recommends galvanism, the negative pole being applied over the seat of the cramp, the positive pole on the thigh.

More suggestions are in circulation regarding the arrest of bleeding from the nose. Dr. Wade (*Deutsche Med. Woch.*) recommends that the hands and feet of the patient be placed in water as hot as can be borne, and asserts that this will check the most obstinate epistaxis.

Dr. Robinson of Kansas, speaking of this subject, says it is well known to anatomists that the hemorrhage, in the vast majority of cases, proceeds from the septum nares, supplied by a branch of the superior coronary, given off from the facial. It euters the nose just below the alæ nasi, crossing the superior maxillary bone at that point.

Firm pressure over this point is the treatment.

Both these plans may be adopted simultaneously.

WHOOPING-COUGH.

Whooping-cough is a disease with which all parents are more or less familiar. A lengthy discussion of it is, therefore, not advisable; but there are a few facts of interest which are not generally known, and which can properly be herein touched upon. The disease in question is infectious, and is easily transmitted from a child suffering from it to others who have not experienced it. Whooping-cough is attended with, and owes its existeuce to, a catarrhal inflammation of the lining membrane of the air-passages. This inflammatiou comes on, runs its course, and gradually subsides, much in the same way that an ordinary acute catarrh does; but during its course, at its height, the peculiar spasmodic cough exists for a time, and then disappears. Whooping-cough, as stated, is contagious, and highly so. The contagious principle, or the peculiar element which excites the disease, is given off in the breath and in the exhalations from the body of a patient suffering from it. After a person becomes exposed, and receives into his system this element, a certain period of development must pass before the disease is brought into existence. Smith has fixed this at four days. He tells of a case where a woman, having a cough for two weeks, which was afterward ascertained to be whooping-cough, went from Boston to a family in New York, She remained with this family several hours, and then left the city. During her stay she held and kissed an infant that was previously well, and had never been removed from the tenement in which it was born. Whooping-cough was not at that time prevailing in New York. Five days after the exposure the infant began to cough, and this proved to be the beginning of a severe whooping-cough.

The disease under consideration may attack persons at any age, but it is most common in children between the ages of one and eight or nine years. Occasionally infants under one year suffer from it, but such cases are comparatively rare. It is believed at the present time that a specific poison, or contagious principle, is alone capable of giving rise to whooping-cough; that without this principle the disease cannot be brought into existence. In other words, a child must take whooping-cough from an infected child or adult, or the contagious principle or poison must be conveyed to it by a third person. Whether it can be transmitted through a third person, and that person be in good health, is not known; but some authorities are inclined to believe in the affirmative. Acceptiug the germ theory, or that a contagious principle is present in all cases, then the only way to escape the disease is to avoid exposure, and never come within the presence of one suffering with it. Whooping-cough can only be experienced once by the same person; that is the rule in many contagious diseases.

When a child is first attacked with the catarrh which ushers in whooping-cough, it is absolutely impossible to determine from the symptoms then presented that that disease exists. They differ little or none from those which appear in an ordinary catarrh; and until the characteristic cough is heard, no one, not even a physician, can say that the attack is more than the simple consequence of taking cold. Not infrequently parents call in their family physician during the first or catarrhal stage, and he considers and treats the attack as a common cold. Later on, when the peculiar spasmodic cough has appeared, and they discover that the child has whooping-cough, then they very often blame him for what they cousider his lack of discernment. That is, of course, wholly undeserved. If the disease was prevalent, or it was kuown that the patient had been exposed to the contagion, he would naturally suspect that whooping-cough was coming on; but to determine positively, in the absence of the characteristic cough, would be impossible for him or any one else.

The symptoms of the catarrh are redness of the eyes, "running of the eyes and nose," sneezing, and some cough, at first similar to that which appears in bronchitis. It is dry, rather hollow, and may be quite annoying. There is usually some fever, more or less thirst, aud impairment of the appetite. The young patient, as in all febrile attacks, is somewhat fretful, aud with difficulty amused. Much of this condition of things lasts for a variable period. It may be for only two or three days, and it may be from four to six weeks; two weeks is about the average. As a general rule,

the severer the attack, the sooner the peculiar cough will be heard.

After the catarrh has existed for a longer or shorter time, the cough changes. It may at once take on that peculiar spasmodic character which gives the disease its name; but more often it changes gradually, and after a few days, very likely a week, it becomes the true whooping-cough. Then, and not until then, are all doubts about the nature of the existing affection dispelled.

After the characteristic cough has appeared, it increases in severity for about three or four weeks — that is, up to about the fifth or sixth week from the commencement of the disease, or the beginning of the catarrhal inflammation. Cases vary much, however, and in not a few the cough persists for a much longer period. Finally a change is noted. During the paroxysms of coughing the patient suffers less; they are shorter, and the disease is unmistakably on the decline. After the improvement is noted, and the cough begins to abate, it generally ceases completely in two or three weeks. If it continues much longer than the time stated, some associated disease of the lungs may be suspected. Relapses, however, are not infrequent; but they are generally of short duration.

But very little can be said upon the subject of treatment in whooping-cough. There is scarcely a disease in which a greater variety of remedies have been tried, and it is safe to say that but a few among them all have proved in any degree effective. During the first stage the treatment should be much the same as in an ordinary catarrhal attack, the consequence of taking cold. If there is much cough previous to the appearance of the true whooping-cough, the treatment indicated would be the same as in a mild attack of bronchitis. When the character of the cough changes, and all doubts about the nature of the disease are set at rest, all attempts of the parents to treat, on their own responsibility, their little ones with medicines, should then cease. The reason for this statement is obvious to those familiar with the disease. There is no drug or mixture of drugs which is appropriate in all cases, nor is there one which is appropriate even in the minority of cases. There are very many medicines still in use in whooping-cough which are totally worthless in any case. There are a few which act well upon some children, and yet, when given to others, do no good whatever. A perfect knowledge of drugs and their physiological effects, also the individual peculiarities of patients, is absolutely essential in the treatment of whooping-cough, and none but intelligent physicians can possess them. Even the best medicinal treatment which can be instituted will be somewhat, at least, disappointing. The disease will run its course, no matter what is given or done. Under proper treatment the severity of the cough will be considerably controlled, and the duration of it may be shortened. There will also be less liability of other diseases being associated. By a judicious selection of remedies, also, the strength of the patient will be maintained, and thus will one of the dangers of whooping-cough be averted. There are so many things to consider, so many emergencies to be prepared for, that it is absolutely impossible to mark out a line of treatment for parents to follow.

In every case of whooping-cough a physician should be consulted early in the attack. He can then give full instructions as to management. After the first consultation, if the child does well, it may not be necessary for him to call again; but every unfavorable symptom demands immediate attention. A child with whooping-cough should be well nourished, and food nutritious in character and sufficient in quantity should be urged upon it. It must be remembered that mental disturbance and physical exertion excite paroxysms: therefore to protect a child as much as possible against all such causes is of great importance. As one writer says, "The children should be commanded to eat slowly and quietly; they should not run nor become heated, and are to be spared all mental disturbances as far as possible. As the witnessing of a paroxysm will also immediately induce one in a child suffering from whooping-cough, it is therefore advantageous to separate such children whenever it is possible. During a fit of coughing, the child's head, as he bends forward, may be supported by the hand. In some cases putting the finger back into the mouth will induce vomiting, and so shorten the paroxysm. Aside from this, there is very little that the mother can do to assist the patient during his distressing attack. — *Boston Journal of Health.*

MEDICAL MEMORANDA.

THE BRITISH MEDICAL ASSOCIATION has twelve thousand members, and a balance-sheet in its favor of over $156,000.

FATAL SEASICKNESS. — It is not often that seasickness proves fatal, and yet that it may do so under aggravated circumstances can easily be imagined. Such an instance recently occurred on the steamer "Dunara Castle," on the trip from Tiree to the Clyde. The patient was a girl aged eight years, in whom the seasickness terminated in a convulsion which proved fatal.

POISONING BY BISMUTH. — The *British Medical Journal* says a case recently occurred in France, in which it is alleged that the application of pure subnitrate of bismuth to ulcers following a burn, at intervals of two days, caused sore throat, with false membrane on the uvula, palate, and tonsils, foul breath, vomiting, and loosening of the teeth.

MARSON'S TEST FOR SUGAR IN THE URINE. — Dissolve two grains of ferrous sulphate in about a hundred and fifty minims of the urine, add five grains of caustic potassa, and boil. A dark-green precipitate forms if sugar is present, and the supernatant liquid is reddish brown or black according to the amount of sugar. When sugar is absent, the precipitate is greenish brown in color, and the liquid is colorless.

VALUE OF RAW MEAT. — Instead of raw *minced* beef, often recommended, scraped beef is far more easily digested, as it is free from sinews, and it is more palatable. It may be prepared as follows: Take a piece of steak cut like a little block, scrape the surface with a silver spoon until all the pulp is extracted, then cut a slice off the steak, and scrape the newly cut surface again. A dessert-spoonful of the pulp for one meal may be given to children, mixed with red-currant jelly, or spread as a sandwich between bread. In the latter case it requires a sprinkling of salt and some pepper. Pulp thus prepared has been taken with great benefit in diarrhœa and debility from any other cause. The above has also been given to consumptive patients with great advantage.

A FALSE DIAGNOSIS. — When the policemen of Philadelphia discover a case of hydrophobia running at large, they seize the unfortunate victim and bind him with a rope to a convenient tree. They then summon the patrol-wagon, and bear him away to the police station. This is unquestionably a judicious procedure, but it involves the necessity of greater powers of diagnosis than are possessed by the average cop. In the latest reported instance in which it was resorted to, it turned out that the sufferer had simply an attack of old-fashioned colic.

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MANAGER.

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CONTENTS.

FAMILIAR SCIENCE.—The Recent Volcanic Explosion in Japan 173
Our Neighbor across the Way 173
The History and Mystery of a Dew-Drop 174
Paris Letter 175
The Number of the Stars 176
Spiders' Webs 176
Scientific Brevities 176

PRACTICAL CHEMISTRY AND THE ARTS.—The Rare Metals, 177
Caricature Photographs 177
Optical Illusions 178
Laboratory Notes 178
Industrial Memoranda 178

HOME, FARM, AND GARDEN.—The Chemistry of Bread-Making 179
The Mandrake 179
A New Method of Potato Culture 179
How to Tell a Horse's Age 180
Some Immense Cakes 180
Gleanings 180

EDITORIAL.—On the Ultimate Causes of Aetion in Animals, 181
The British Association at Bath 182
Meteorology for October, 1888 183
Astronomical Phenomena for December, 1888 184
Another Tree-Pruner 184
Questions and Answers 184
Literary Notes 184

MEDICINE AND PHARMACY.—Minor Ailments 185
Climatology and Health-Resorts 185
Treatment of Snake-Bite 186
Teeth as Conservators of Nerve Force 186
Monthly Summary of Medical Progress 187
Degeneration of the Human Teeth 188
Humors 188

PUBLISHERS' COLUMN 188

Familiar Science.

THE RECENT VOLCANIC EXPLOSION IN JAPAN.

THE past few years have been remarkable for the number of destructive volcanic eruptions in various parts of the world. The explosion of Krakatoa, where an entire island was blown into the air, occurred only five years ago; and a short time afterwards a tract of country in New Zealand, several miles in extent, was converted into "a land of fire." The latest volcanic catastrophe is reported from Japan, where, on the 15th of last July, a large portion of Mount Bandai was broken up into dust and fragments, and scattered over the adjoining country. The accompanying illustration (Fig. 1) shows the appearance of a formerly fertile valley after it was filled with *débris* from the explosion, and is from a photograph taken by Mr. W. K. Burton of Tokio, who was sent by the Japanese government to investigate the explosion, and whose report is published in the *British Journal of Photography*. Fig. 2 is a diagram showing the part of the mountain destroyed by the explosion.

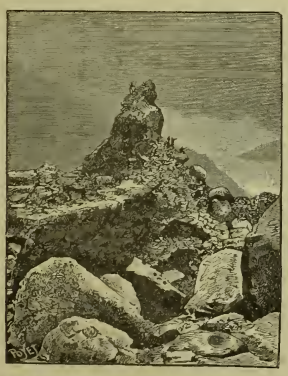


FIG. 1.

This phenomenon is properly spoken of as an explosion rather than as a volcanic eruption. There was no trace of lava or igneous phenomena of any kind. It was simply an immense explosion like that of a steam-boiler, where the overlying mountain was torn apart by the force of the steam generated by the terrestrial heat. Clouds of steam escaped from the ground in the vicinity of the mountain for some time after the explosion; and when the pressure was first relieved by the destruction of the mountain, torrents of water and mud rushed down the valleys, causing immense loss of life and damage to property.

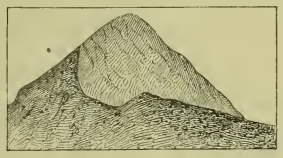


FIG. 2.

In some respects this explosion is similar to the eruption which destroyed Pompeii, when a large part of Mount Vesuvius was destroyed; but in that instance the usual igneous phenomena were more evident, although the loss of life was apparently much less. The dwellers at the foot of Vesuvius had ample warning of the eruption before it took place, but the unfortunate Japanese appear to have had no opportunity to escape the catastrophe.

[Original in *The Popular Science News.*]

OUR NEIGHBOR ACROSS THE WAY.

BY PROFESSOR C. A. YOUNG.

THE planet Mars occupies in the solar system the orbit next outside the Earth's, and at times comes nearer to us than any other heavenly body, excepting only the Moon and the planet Venus, or now and then a stray comet. But when Venus is nearest the Earth, her illuminated surface is turned away; so that the Moon alone offers better opportunities for telescopic examination than does Mars when, at its opposition, it is for a season the chief ornament of the evening sky.

The reader must not, however, imagine that, because the planet is then nearer than other heavenly bodies, its distance is really comparable with any geographical distances on the earth's surface. Even under the most favorable circumstances, the distance is never less than about 36,000,000 miles, which is about 150 times that of the Moon, and a full century's railway journey for a "celestial limited," running forty miles an hour, without stops. Even with a magnifying power of a thousand, which is about the highest that can be advantageously used on any but the very largest telescopes, and under exceptional circumstances, the planet is still optically fully 36,000 miles away, and shows in the field of view a disk about 6½° in diameter, upon which the smallest objects visible would need to be 25 or 30 miles across. A rather powerful field-glass, with a magnifying power of six or seven, would bring the Moon as near.

It is only about once in fifteen years that Mars comes as near as even 36,000,000 miles. Its orbit is so eccentric, that the interval between it and the orbit of the Earth varies all the way from 36,000,000 miles to 61,000,000; and it is only now and then that, as the two planets circle round in their respective tracks, the passing point is where the tracks come nearest. The last instance of a very close approach was in 1877; the next will be in 1892.

Mars is much smaller than the Earth, its diameter being only about 4,200 miles; its bulk therefore is only about one-seventh, and its surface about three-tenths, of the Earth's.

By means of the motion of its swift little moons, it is easy to ascertain that its "mass" (i.e., the quantity of matter it contains) is somewhat less than one-ninth of the Earth's, and consequently its density is only three-fourths, and its superficial gravity just about three-eighths, of the Earth's; i.e., a body which at the Earth's surface weighs 100 pounds, would weigh only 38 pounds there, and a force which here would project a body to an elevation of 100 feet, would throw it there to a height of 265. This is a point of considerable importance in considering the physical conditions of the planet.

When examined by the telescope under favorable conditions, Mars is a very pretty and interesting object. It shows a ruddy disk, which, for some not certainly known reason, is much brighter at the edge than near the centre; in this respect resembling Mercury, Venus, and the Moon, but standing in marked contrast with Jupiter and Saturn. According to Zöllner, the "albedo," or reflecting power, of its surface is about twenty-six per cent; that is to say, it reflects about twenty-six per cent of all the light which falls upon it,—about as much as ordinary sand. This is considerably higher than the albedo of either Mercury or the Moon, but only about half that of Venus or any of the major planets.

Just at the time of opposition the disk is, of course, perfectly circular; but at other times it is more or less "gibbous," like the moon a day or two from the full. It varies greatly in apparent size according to the changing distance of the planet, which ranges all the way from 250,000,000 miles to 36,000,000.

The disk is mottled with spots and streaks, which are not arranged in belts with an evident relation to the planet's equator, as in the case of Jupiter and Saturn, but are distributed irregularly over the surface. A telescope of not more than seven or eight inches aperture shows them fairly well, and the more conspicuous of them can be seen with much smaller instruments. As we watch them, they drift across the disk from east to west, and many of them are so permanent and well defined, that by their help we can ascertain the length of the planet's day with very great accuracy. The latest and probably most precise determination is that of Bakhuyzen, who gives the time of rotation as 24*h*. 37*m*. 22.66*s*. The only question is as to the odd hundredths of a second.

Most of the spots and markings are permanent, but not all. Bright patches are now and then observed which seem to be evanescent, like sheets of cloud that for a time conceal the oceans and continents beneath, and then rapidly clear away.

Such phenomena, of course, imply an atmosphere more or less like our own, and Dr. Huggins has confirmed the fact by a direct observation of the lines of water-vapor in the planet's spectrum. But many things go to show that this atmosphere is much less dense and extensive than the Earth's. On Mars great storms and widespread cloud-veils are comparatively rare; for the most part the real features of the planet's surface are clearly seen, uncomplicated by overlying mists, while the surface of the earth at any given moment would probably be fully half obscured, as seen from the Moon or Mars.

The planet's equator is inclined to its orbit at an angle of nearly 28°, and, as a consequence, Mars ought to have seasons much like those of the earth. One very beautiful phenomenon seems to show that this is actually the case. In the neighborhood of the planet's poles there are brilliant spots, evidently composed of some substance which reflects light very abundantly; and it is natural to think of ice or snow, because, as Sir W. Herschel observed a century ago, each spot grows larger when it is turned away from the Suu, and dwindles in the summer, just as a polar ice-cap would. It is worth noting that this snow-cap, if such it really is, never comes down to middle latitudes, as does the wintry envelope of our terrestrial snow. In January "the man in the Moon" would see pretty much all that portion of the Earth's northern hemisphere which lies above 45° of latitude as one gleaming white expanse, unbroken except where the Atlantic and Pacific Oceans interrupt its continuity. Although Mars is so much farther from the Sun than the Earth is, and receives less than half as much heat to each square mile of surface, it presents no such prevalence of ice in either hemisphere.

This can hardly be due to the scanty supply of water, because the study of the planet's surface-markings seems to indicate that nearly half the globe is covered by seas and oceans; not, indeed, nearly so large a fraction of the whole as in the case of the earth, but quite enough to furnish a fair supply of rain and snow.

The northern hemisphere of Mars is of a comparatively uniform orange-colored tint, and is supposed to be mainly land, though it encloses certain dark spots, which, likely enough, are inland seas. The southern hemisphere, on the other hand, is for the most part darker, with here and there islands of the lighter-colored surface. From this southern ocean, as it is supposed to be, great bays like that of Bengal, and arms like the Red Sea and the Baltic, penetrate deeply into the northern continent; indeed, as Proctor long ago remarked, a very striking characteristic of Mars is the manner in which land and water are divided and intermeshed, there being on the planet no unbroken mass of land to correspond to the Asiatic continent, nor any ocean like the Pacific.

The principal features of the planet's geography (strictly areography) are now quite beyond question, and have been several times fairly mapped. Thus far, however, no satisfactory nomenclature has been settled. Upon Mr. Proctor's map the names assigned are mostly those of astronomers who have made contributions to our knowledge of the planet's topography. Thus we have the continents of Herschel, Dawes, Mædler, and Secchi, the oceans of Dawes and De la Rue, and the seas of Kaiser, Beer, and Delambre. Schiaparelli, on the other hand, with better taste derives his names from ancient geography and legend. We have for the land masses, in the order before-mentioned, Libya, Acria, Arabia, and Chryse. Syrtis Major replaces the Kaiser Sea (which is, on the whole, the most conspicuous object on the planet), and De la Rue Ocean becomes the Mare Erythræum. But while the principal features of the planet's configuration are thus fairly well made out, especially those near its equator, there is no such agreement in minor details, and the different maps are widely at variance. Schiaparelli of Milan, who has had the great advantage of the Italian atmosphere, has introduced into his charts a great number of delicate objects which have never been satisfactorily seen by others, though many partial confirmations have been obtained. In place of the comparatively ill-defined and hazy streaks seen here and there by other observers, he represents the northern hemisphere of the planet as covered by a network of fine, hair-like lines, which he calls "canals," and supposes to be water-ways. Some of these extend over 90° of the planet's circumference, or nearly 3,000 miles in length, with a width not to exceed 30 or 40 miles.

In Schiaparelli's map of 1877, which is the one usually copied in the text-books, only a few of the canals appear, but on his more recent charts there are nearly sixty of them.

The most remarkable thing about them remains to be stated: In 1881 he found most of them to be *doubled;* the single lines which intersect the continental masses had almost without exception become *pairs* of parallels, like the two tracks of a railroad, with a very uniform distance of 150 or 200 miles between them. We say "had become," because it is his opinion that this "gemination" of the canals is a temporary phenomenon, depending somehow on the progress of the martial seasons.

These observations have naturally excited much discussion, and at present scientific opinion is considerably divided in regard to them. No other astronomer has been able to observe the canals in any such extent and perfection as Schiaparelli with his telescope of only eight inches aperture; but several others, especially Perrotin at Nice, have seen something of the sort, and furnish a partial confirmation of his work. The "gemination" of the canals is so remarkable and so inexplicable, that many are disposed to think the phenomenon a purely optical one, due to some astigmatism and imperfect focus of either the instrument or of the observer's eye; or else (as Mr. Proctor suggested rather vaguely) an effect of diffraction in some way. If it were not for the observations of Perrotin, I for one should accept the theory of astigmatism, for I have myself often seen delicate single lines in the solar spectrum appear double from some slight pinch of one of the lenses in the spectroscope. But it is very difficult to see just how two different observers, with two such different instruments as the twenty-nine-inch telescope at Nice and the little eight-inch at Milan, could see the phenomenon alike if it were merely optical. There is some mystery about the matter, and it is clear that we must wait for further and more conclusive evidence before building any considerable structure of theory upon the reported facts. The only suggestion so far made which seems worthy of mention here is, that the "canals" may be water-courses of some sort, at times flooded, and at other times drained off, so as to become invisible.

During the last opposition (in April) the planet's nearest approach to the earth was about 56,000,000 miles, and it was so far south in the sky, that it could not be very well observed in Europe or this country. But both at Milan and Nice some of the canals were seen, and seen as double for a time. Perrotin also reported that a continental tract which he had named Libya (a part of Proctor's "Herschel Continent") *had mostly disappeared, as if inundated.* While this observation of his is partially confirmed by some observers, it has been positively disputed by others. With the Lick telescope, Libya was seen last spring by Professor Holden on several occasions; in fact, whenever it was favorably placed for observation at the time the telescope happened to be directed on the planet. Nor was any thing seen at Mount Hamilton like the "gemination" of any of the canals, though in some instances a widish streak was observed, in place of the sharp and narrow line delineated on the map.

The two little satellites (discovered by Professor Hall at Washington in 1877) were, of course, seen and easily observed.

It is to be hoped, and expected, that the great telescope on Mount Hamilton, with its advantages of situation and its freedom from the atmospheric embarrassments which so seriously interfere with the work of our other large instruments, will in 1890 and 1892 be able to solve definitely the interesting problems that our neighbor proposes for our investigation.

PRINCETON, *Nov.* 9, 1888.

[Original in *The Popular Science News.*]

THE HISTORY AND MYSTERY OF A DEW-DROP.

A CHAPTER FOR YOUNG PEOPLE.

BY SAMUEL BRAZIER.

IN any of the fairy scenes of nature what can be found more innocent, more beautiful and pure, than a morning dew-drop glistening in the cup of a flower? Sometimes from a distance of several yards away it reveals its presence by the bright ray of light it has just received from the sun, and flashes out again. You approach the glistening little object, and try to look into its tiny depths. From one point of view it is dark, almost black; from another it is so bright that you cannot look into it at all: its reflected ray is as pure and intense as that of the most brilliant diamond. Then, looked at in a different direction, it is clear and transparent, looking so cool and beautiful. There it is, trying to be a perfect little globe, which it would be if it were not for the pressure of its weight on the petals of the flower. But see, while you look into it, and admire it, it gradually becomes less and less, till, kissed by the rays of the morning sun, it vanishes away. The heat contained in the rays of light that were passing through it was sufficient to overcome the mutual attraction of the molecules of water of which it was composed, and alter its form from liquid to vapor. It has again become invisible moisture, and floated away in the air, from which, during the night, when the air was cooler, and therefore more contracted, and unable to hold so much moisture, the little dew-drop was squeezed out into the cool cup of the flower. Where did it come from, and how did it get into

the night air, ready to be deposited as dew? and where is it gone to now, and what changes will it undergo? The dew-drop has become invisible, but is it lost? No; no atom of matter can ever be lost or destroyed, or cease to be of use. It is as impossible to annihilate an atom of matter as to create one. The liquid gem that glistened in the rays of the morning sun disappears from view, but in the form of invisible vapor it may be inhaled by the breathing leaves of plants or trees, or it may rise to become again visible in the floating cloud, and, by reflecting and refracting the solar rays, may help to paint the glowing sunset. To-morrow it may descend to the earth again as rain, to be drunk up by the roots of some thirsty plant, or serve to refresh some happy singing-bird, so entering into the composition of animal or vegetable form; or it may trickle through some crevice in the ground into the reservoir beneath, and, mingling with the streams that flow in the interior of the earth, may ooze out again in some cool spring, join the stream of the valley, rippling and dancing on its way to swell the volume of the river, dash down the waterfall, and then emerge into the ocean, there to be again evaporated by the sun, or sparkle on the crest of the wave that the tide rolls in upon the shore; or the dew-drop that to-day is exhaled from the heart of a flower, and rises to become cloud, may be carried by winds hundreds of miles away into colder regions, and fall in the form of hail or snow. It may roll down in the avalanche into the valley, or, falling as a snow-flake on some lofty mountain-peak, it may form part of the glacier or ice-river that glides slowly down the valley into the sea. There it dips down into the water; but, ice being lighter than water, it tends to rise to the surface, and occasionally immense blocks of ice are broken off and float away. These are the icebergs, which, floating into warmer latitudes, gradually melt and mingle with the waters of the ocean.

But through all these various transformations the dew-drop continues to be water. Its changes from solid to liquid and from liquid to aeriform are caused by differences of temperature. These are physical changes. It may, however, undergo chemical changes, by which it may cease to be water in any form. Water is composed of two invisible gases, — hydrogen and oxygen. Oxygen has a strong affinity for iron. If the dew-drop is deposited on iron instead of a leaf or flower, the iron robs the water of some of the atoms of oxygen, and lets the hydrogen go free. This union of iron with the oxygen of the water forms the thin film of rust, or red oxide of iron, observable on iron that has been exposed to dew or rain.

In other ways also water may be decomposed, and its oxygen or hydrogen enter into the composition of other substances. So the dew-drop we admire to-day may continue to be water in the form of vapor, or liquid, or solid ice, or snow, for thousands of ages; or it may be decomposed in a few hours, and cease to be water in any of its forms. Nor can we tell how long the dew-drop has been water. It might have been water in some form for ages, or it might have been created by the decomposition of some other substance a few hours ago. Coal-gas, which is used to light the streets, contains hydrogen, which in burning unites with the oxygen of the air to form water, which passes away as invisible vapor. The watery vapor, therefore, which has been condensed to form the dew-drop, may have been produced during the night by the burning of the gas in the streets. The cool dew-drop might be born of the burning flame. Its atoms might have been sleeping for ages, hundreds of yards below the present surface of the earth, in the coal-bed composed of the vegetation of some forest of the ancient world. Or they might have entered into the formation of some limestone rock on which the beds of coal rested, or the more ancient granite rock, still lower down in the earth. There each tiny atom might have done its best for ages to uphold the mighty mountain above it, till, rent by earthquakes or melted by internal fires, and poured forth from the crater of some volcano, it was again brought under the influences of sun and air, of heat and light, and moisture and frost, and subjected to physical and chemical changes, till it came to sparkle in the morning dewdrop.

But, whatever wondrous transformations the dew-drop may have passed through, we know that it existed even when there was no cooling dew, nor thirsty flowers, nor forests, nor fields, nor lofty mountains, nor pleasant valleys, nor rolling rivers, nor widespread ocean, nor solid land; when the earth and all it now contains was vapor. "The earth was without form and void." During ages longer than we can count, this great mass of vapor cooled down till some parts became solid; some still remain fluid, and others gaseous, as the air that surrounds the globe. From a shapeless mass of vapor it has been slowly transformed into the beautiful world it is to-day, where flowers bloom, and birds sing, and children play. During all those long ages each atom in the dew-drop has existed somewhere in some form. Each atom of hydrogen or oxygen or each molecule of water has done its duty and served some useful purpose. So it will continue to do in the countless ages to come. It will never be destroyed nor lost. It will be useful or beautiful somewhere for ever.

How many questions must be asked and answered, how much and how varied information must be obtained, before we can understand the history and mystery of a dew-drop! The tiniest object in nature may suggest inquiries which may lead us into delightful paths in the broad fields of knowledge. A flower, a grain of sand, the commonest pebble you can pick up in the road, have each a wonderful story to unfold to those who take the pains to inquire and learn. So with this drop of dew. If we would follow out all the inquiries it suggests, we should have to study those same laws of nature that made the dew-drop round and the earth a sphere, and control the motions of planets and stars. We must learn how the dew-drop differs from a rain-drop, or the hailstone or snow-flake, or from cloud and fog and mist, into all of which it may be transformed. It is one form of water. Water has compressibility, specific gravity, and other physical and chemical qualities which enable it to perform very important uses in the life of animals and plants, and in the formation of wells in the earth. On the surface of the earth water occurs as lakes, streams, rivers, and the great ocean. So we should have to learn the influences of the ocean, lakes, and rivers on the climate of the globe, and their uses to man; and watersheds and hydraulic engines would demand attention. Then, water occurs in the form of rivers and lakes underground, where it is an active agent in causing earthquakes and forming caves. It reappears as springs which are sometimes fresh, sometimes salt. Some springs contain large quantities of mineral matter; some are cold, some are hot. Intermittent springs, geysers, artesian wells, would form subjects of inquiry. A whole chapter is required even to indicate the various subjects of study in many different sciences that must be pursued, and a lifetime may be spent in acquiring the knowledge that is necessary to enable us to understand the history and mystery of a dew-drop.

The famous pear-tree planted in 1630 by Gov. Endicott at Danvers, Mass., having reached the age of over two hundred and fifty years, died recently.

[Special correspondence of *The Popular Science News.*]

PARIS LETTER.

Studies and experiments concerning infectious diseases are always very numerous, and Professor Pasteur has opened new ways to medicine, and most of the results obtained in the new field are of real importance. Concerning the rabic virus, M. Galtier of Paris has made some interesting experiments on the resistance of this virus to desiccation and to cadaveric putrefaction. The point is one of importance, as it is very useful to know how long dried or putrefied rabic virus remains dangerous. Dried virus loses its virulence in a pretty short time, according to M. Galtier's experiments; the minimum being four days, when the rabic matter forms only a thin layer. Hence the conclusion that clothes contaminated with rabic virus cease to offer any danger when they have been allowed to dry during five or six days. M. Galtier considers also that it is quite useless to taboo the pastures in which rabid animals have been, during a month or two, as is often done, and believes that an interdiction of four or five days is enough. It is not enough, however, for contaminated waters, as the virus remains virulent a much longer time in water than when dried.

M. Galtier showed, a year ago, that the medulla oblongata of a rabid dog, buried fifteen days, keeps all its virulence; new experiments have demonstrated the fact that the virulence is not abated in the corpses of rabid animals, even after thirty and forty-five days' inhumation, when the venom centres are putrid and diffluent. This fact is an important one also, since, even after five or six weeks, it can be positively ascertained whether a suspected animal was rabid or not.

Although the opinion of physicians and physiologists often varies as concerns the toxic effects of copper salts, it is generally considered that the use of copper vessels in culinary operations is detrimental to health, and nickel has been much praised as a substitute for copper. MM. Laborde and Riche, after many physiological experiments, have come to the conclusion that nickel salts must be absorbed in considerable quantity before becoming obnoxious, and that the use of nickel vessels in culinary or pharmaceutical operations is without the slightest danger to health.

Recent experiments on the effects in the human body of the new French balls (Lebel gun) have shown many interesting facts. The ball of the Lebel gun is a small one (8 millimeters diameter, instead of 11), which travels faster than those formerly used (570 meters per second, instead of 450), and is clad in a dress of *maille-chort* [German-silver], which gives it a greater hardness. It produces much smaller wounds, and these are more limited than with the other balls; bones are not so much shattered; and the fact that the ball does not (up to the distance of 1,200 meters) remain in the body, renders the treatment much easier. The Lebel ball may be considered as a humanitarian and philanthropic instrument, in a large measure.

Tuberculosis is being studied with much zeal in all parts of the scientific world, and many new methods of treatment are being experimented, of which most are based on the antiseptic principles. Tannin, hydrofluoric acid, iodoform, aniline, have been successively praised and more or less abandoned. Now M. Halter proposes hot-air inhalations once or twice a day, lasting a quarter or half an hour. The temperature of the air, which must be quite dry, must be between 248° and 374° F., so that the heat of the intrapulmonary air

ranges between 105° and 113°, which is the necessary temperature to kill the bacilli.

M. Krull recommends a similar method, but the temperature of the air must not exceed 115°. Upon the whole, nothing is known of the positive effects of these methods. M. Dettweiler of the Falkenstein Sanatorium has recently published (F. Alcan, publisher, Paris) a very interesting *brochure* on the method followed in his Sanatorium, which is exclusively devoted to tuberculous patients. The main points of the method are to oblige the patient to live in the open air under all circumstances, and to sleep in open halls or on verandas, however cold it may be (23° and 14° F. !). The great point is to have the patient always breathe pure air. The temperature seems to have no influence, since the results are the same in summer and in winter; and as the patients are well covered, to prevent chill and cold, they become rapidly accustomed to the method, and feel so much improved, that they like it greatly. The proportion of successful cases is twenty-five per cent, and the perusal of M. Dettweiler's *brochure* is really very interesting.

M. HALLEZ of Lille has recently published a very interesting note concerning the different animals which fulfil the duties of scavengers of the sea-beach, and destroy all animal corpses and vegetable *detritus* which are washed up by the sea, or brought by rivers. Even at very short distances, the scavengers are of quite different sort: in one place it is the genus *Nassa;* in another a crustacean, *Eurydice pulchra*, or species of *Ligia* and *Orchestia*.

A STATUE of Ampère has been recently unveiled, and a new sanatorium for scrofulous and tuberculous children opened in Banyulis-sur-Mer, on the Mediterranean.

V.

OCT. 23, 1888.

THE NUMBER OF THE STARS.

THE total number of stars one can see will depend very largely upon the clearness of the atmosphere and the keenness of the eye. There are in the whole celestial sphere about 6,000 stars visible to an ordinarily good eye. Of these, however, we can never see more than a fraction at any one time, because a half of the sphere is always below the horizon. If we could see a star in the horizon as easily as in the zenith, a half of the whole number, or 3,000, would be visible on any clear night. But stars near the horizon are seen through so great a thickness of atmosphere as greatly to obscure their light, and only the brightest ones can there be seen. As a result of this obscuration, it is not likely that more than 2,000 stars can ever be taken in at a single view by any ordinary eye. About 2,000 other stars are so near the South Pole that they never rise in our latitudes. Hence, out of 6,000 supposed to be visible, only 4,000 ever come within the range of our vision, unless we make a journey towards the equator.

As telescopic power is increased, we still find stars of fainter and fainter light. But the number cannot go on increasing forever in the same ratio as with the brighter magnitudes, because if it did the whole sky would be a blaze of starlight. If telescopes with powers far exceeding our present ones were made, they would no doubt show new stars of the twentieth and twenty-first, etc., magnitudes. But it is highly probable that the number of such successive orders of stars would not increase in the same ratio as is observed in the eighth, ninth, and tenth magnitudes, for example. The enormous labor of estimating the number of stars of such classes will long prevent the accumulation of statistics on this question; but this much is certain, that in special regions of the sky, which have been searchingly examined by various telescopes of successively increasing apertures, the number of new stars found is by no means in proportion to the increased instrumental power. If this is found to be true elsewhere, the conclusion may be, that, after all, the stellar system can be experimentally shown to be of finite extent, and to contain only a finite number of stars. In the whole sky an eye of average power will see about 6,000 stars, as I have just said. With a telescope this number is greatly increased, and the most powerful telescopes of modern times will show more than 60,000,000 stars. Of this number, not one out of one hundred has ever been catalogued at all. . . . In all, 314,926 stars, from the first to the ninth and a half magnitude, are contained in the northern sky, or about 600,000 in both hemispheres. All of these can be seen with a three-inch objectglass. — PROFESSOR E. S. HOLDEN, *in the August Century*.

SPIDERS' WEBS.

I READ a statement in this magazine not long ago, about the spiders' webs that cover the fields and meadows on certain mornings in the summer, which was not entirely exact. It is not quite true, in the sense in which it was uttered, that these spiders' webs are more abundant on some mornings than on others, and that they presage fair weather. Now, the truth is, that during the latter half of summer these webs are about as abundant at one time as at another; but they are much more noticeable on some mornings than on others, — a heavy dew brings them to view. They are especially conspicuous after a morning of fog, such as often fills our deeper valleys for a few hours when fall approaches. They then look like little napkins spread all over the meadows. I saw fields last summer in August when one could step from one of these dew-napkins to another for long distances. They are little nets that catch the fog. Every thread is strung with innumerable fine drops, like tiny beads. After an hour of sunshine the webs apparently are gone.

Most country people, I find, think they are due to nothing but the moisture; others seem to think that the spiders take them in as morning advances. But they are still there, stretched above the grass at noon and at sunset, as abundant as they were at sunrise, and are then more serviceable to the spiders, because less visible. The flies and insects would avoid them in the morning, but at midday they do not detect them so readily.

If these webs have any significance as signs of the coming weather, this may be the explanation: —

A heavy dew occurs under a clear, cool sky, and the night preceding a day of rain is usually a dewless night. Much dew, then, means fair weather, and a copious dew discloses the spiders' webs. It is the dew that is significant, and not the webs. — JOHN BURROUGHS, *in St. Nicholas*.

SCIENTIFIC BREVITIES.

PRESERVATION OF DESMIDS. — It is stated by W. Migula that desmids and other species of freshwater algæ may be preserved for microscopic mounts, with the complete prevention of protoplasmic contraction, by treating them first with a one per cent solution of perosmic acid for from ten to twenty minutes, and then placing them in a concentrated solution of potassium acetate, for mounting or for permanent preservation.

THE SIGNAL SERVICE. — Gen. Greely, in his annual report, says that the percentages of successful weather-predictions made by the signal office for the year were 78.4; wind, 75 5; temperature, 74.2; general average, 76.7. The number of cold-wave signals displayed was 1,743, of which 1,240, or 71.5 per cent, were verified.

A LEATHER-WORM. — Professor Riley, the eminent entomologist, has discovered an insect which preys upon boots and shoes. The pest can be destroyed by a vapor of bisulphide of carbon.

QUICKSAND. — Quicksand is composed chiefly of small particles of mica mixed largely with water. The mica is so smooth, that the fragments slip upon each other with the greatest facility, so that any heavy body which displaces them will sink, and continue to sink, until a solid bottom is reached. When particles of sand are ragged and angular, any weight pressing on them will crowd them together until they are compacted into a solid mass. A sand composed of mica or soapstone, when sufficiently mixed with water, seems incapable of such consolidation.

ELECTRIC HEAT INDICATORS, consisting of thermometers incased and protected by iron tubes, provided with platinum wires, and connected to a system of electric bells and indicators on deck, are the latest invention for preventing spontaneous combustion among ship cargoes. Should any undue heat arise in any part of the cargo, the mercury in the thermometers will rise, make contact with the platinum wire, and give an instantaneous alarm on deck, indicating at the same time the exact spot where the heat exists.

THE FIRST LIGHTNING-ROD. — If we are to believe an Austrian paper, says *La Lumière Electrique*, the first lightning-rod was not constructed by Franklin, but by a monk of Seuftenberg, in Bohemia, named Prohop Diwisch, who installed an apparatus the 15th of June, 1754, in the garden of the curate of Prenditz (Moravia). The apparatus was composed of a pole surmounted by an iron rod supporting twelve curved-up branches, and terminating in as many metallic boxes filled with iron ore and closed by a boxwood cover, traversed by twenty-seven sharp iron points, which plunged at their base in the ore. All the system was united to the earth by a large chain. The enemies of Diwisch, jealous of his success at the court of Vienna, excited the peasants of the locality against him, and, under the pretext that his lightning-rod was the cause of the great drought, they made him take down the lightning-rod which he had utilized for six years. What is most curious is the form of this first lightning rod, which was of multiple points, like the one which M. Melseu afterwards invented.

CLIFF DWELLINGS IN MOROCCO. — Recent discoveries have shown that cliff dwellings are found in great numbers in Morocco, which are now, and probably have been, inhabited from the time of their first construction. These dwellings in all particulars are like those found in Arizona and New Mexico on this continent. A New York paper speaks of them as follows: "It was not until last year that the Moors would permit any examination of the cliff dwellings which have long been known to exist some days' journey south-west of the city of Morocco. The strange city of the cave-dwellers is almost exactly like some of those in New Mexico and other territories, which archæologists have explored. The dwellings were dug out of the solid rock, and many of them are over two hundred feet above the bottom of the valley. The face of the cliff is, in places, perpendicular; and it is believed that the troglodytes could have reached their dwellings only with the aid of rope-ladders. Some of the dwellings contain three rooms, the largest of which are about seventeen by nine feet, and the walls of the larger rooms are generally pierced by windows. Nothing is known as to who these cave-dwellers were."

Practical Chemistry and the Arts.

THE RARE METALS.

Chemists have found about seventy-one different forms of matter, which they call elements, and are apparently simple forms of matter incapable of further subdivision. We say *about* seventy-one different forms, because some of these so-called elements have been but little studied, and resemble each other so closely that they may be proved to be identical, or to be mixtures of still simpler forms. The question of the true nature of the elements has been frequently discussed in these columns, but is not connected with the present subject.

Of these seventy-one elements, fifty-six are metals and fifteen metalloids. It is rather difficult to exactly define a metal; but their general appearance is familiar to every one, and a special article upon this question will be found in the *Science News* for March, 1887. Only about thirty elements are at all common, and not more than twenty are met with in daily life. Sixteen of these are of a metallic nature, leaving forty different metals which are rarely seen outside of a laboratory or mineralogical cabinet, but which in their chemical relations are of considerable interest.

Beginning with that group of elements containing the familiar substances sodium and potassium, we find three other metals closely allied to them, — lithium, rubidium, and cæsium. Lithium is more abundant than the other two, and is found in considerable quantity in many mineral-spring waters, including those at Saratoga.

It is the lightest solid element known, having a specific gravity of 0.59, or about one-half that of water.

Cæsium and rubidium were also first discovered in mineral water by Bunsen and Kirchoff in 1860. There were only two or three grains of the metals to a ton of water, and their detection would have been impossible, except for the spectroscope, which showed the blue line of cæsium and the red one of rubidium, when even this minute quantity was present. The metals themselves present no especial peculiarity of appearance, and could hardly be distinguished by sight from a piece of sodium or potassium.

In the calcium and magnesium group, we find barium and strontium, which, while not very rare, have but few practical uses. Strontium is largely used for making red fire, while barium gives a green hue to the flame. Cadmium is a metal resembling zinc, and is only important as being a constituent of the fusible alloys used for safety-plugs in steam-boilers, automatic sprinklers, etc.

Aluminium is no longer an uncommon metal; but there is a long list of similar metals which are quite rare, and of little or no practical importance. They resemble each other very closely, and it is by no means certain that they are all distinct elements. The elements yttrium, erbium, terbium, phillipium, ytterbium, and samarium are very slightly differentiated, and are compared by Dr. Crookes to the refuse of the universe "heaped away in some cosmical lumber-room;" while the deceptive nature of another supposed element is expressed by its name, decipium. Gallium and germanium were discovered by French and German chemists respectively; while scandium is remarkable, as agreeing in its properties with a theoretical element which was required to fill a vacant place in the "periodic system" of the elements, but was until quite recently unknown.

Glucinium is found in the emerald and beryl, and some of its salts have a sweetish taste. Zirconium is the base of the rare minerals zircon and hyacinth, and thorium is remarkable for its specific gravity (9.4) and the highest atomic weight (232) of any element. Cerium is used to a small extent in medicine, and lanthanum and didymium closely resemble it. The name "lanthanum" means "to lie concealed," and was given on account of the difficulty of its detection; and didymium closely resembles it, as the meaning ("twinned") of its name implies. Indium was discovered by the blue line which it gives in the spectroscope, and uranium is only used for the purpose of coloring glass and porcelain.

Thallium is a metal resembling lead, and gives a green line in the spectroscope, by which it was first discovered. Titanium is related to tin, and is an undesirable constituent of certain iron ores. It also imparts a yellow color to glass and porcelain. Tungsten is a valuable addition to steel; and tungstate of soda, applied to wood or clothing, renders them uninflammable. Niobium and tantalum resemble each other very closely, but are of little importance.

Molybdenum belongs to the iron group, which also includes nickel, cobalt, and manganese. Vanadium is allied to antimony and nitrogen, and has been found to possess a remarkable oxidizing power. It is extensively used for the production of aniline black in dyeing and calico-printing establishments. About one per cent of vanadate of ammonia added to an infusion of nut-galls makes a very superior black ink, which, however, will partially fade in time.

We come, last, to the rare metals of the platinum group, of which iridium is the most useful, as, on account of its excessive hardness, it is used for the points of gold pens and stylographs, the knife-edges of balances, etc. Osmium is one of the most poisonous substances known; while palladium is remarkable for the readiness with which it combines with hydrogen, apparently forming an alloy, and indicating the metallic nature of that gas. It has lately been used as a substitute for steel in certain parts of watches, to avoid the effect of magnetism on the works. Ruthenium and rhodium are of no special interest.

There are probably many other metals in existence which remain to be discovered. We are familiar with but a small portion of the crust of the earth, and know nothing of what there may be at a little distance below it. In the "periodic system" of the elements there are several gaps yet remaining to be filled, and elements possessing the required properties may some time be discovered. Whatever new elements may be found, will undoubtedly occur in very small quantities; but at present there seems to be no limitation to the number of "rare metals" ready to indicate their presence in the spectroscope, beakers, or crucibles of the chemist who patiently searches for them.

CARICATURE PHOTOGRAPHS.

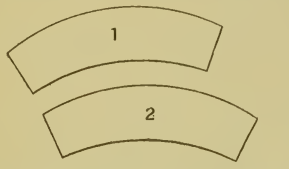
It is an easy matter for the photographic amateur to produce distorted portraits, similar to those represented in the engraving, with an ordinary camera. The method as described in *La Nature* is as follows: —

A full-length picture is taken in the usual way, against a perfectly plain background, and without any accessories. From this negative a positive on glass is made by placing it in a printing-frame against a sensitive glass plate, and exposing to the light of a lamp or candle for a few seconds. The positive transparency is developed and finished, and placed before the camera so that the light passes through it, but inclined at an angle to the camera, either lengthwise or sidewise according as the image is to be shortened or lengthened, and a second negative taken which will give the distorted figures shown in the engraving. To obtain the best results, the lens used in taking the distorted picture must be of very short focus,

and as small a diaphragm used as is possible. From the second negative thus produced, any number of positives can be printed.

OPTICAL ILLUSIONS.

Figs. 1 and 2 represent two figures with curved sides. One would say at the first glance that Fig. 2 is much the longest, but actual measurement will show that they are of exactly the same size. The illusion is due to the fact that Fig. 1 is really



pushed considerably to the left, although, as the left-hand ends of both, are nearly in the same line, the displacement is not apparent.

Fig. 3 is another similar illusion. The fine dots on the lower line are exactly the same distance apart; but the differently shaped triangles placed above them so confuse the eye, that the distance

Fig 3.

between the dots at the ends and the adjoining ones appears greater than between those in the middle of the line. The old proverb is not quite true; for "seeing" is not always "believing," as the above diagrams show.

LABORATORY NOTES.

New Reagent for Salts of Copper. — A solution of neutral sodium sulphite in which a little pyrogallic acid is dissolved, gives an intense blood-red solution in aqueous copper solutions of medium concentration.

Desiccation of Gases. — Dibbits has previously shown how much moisture remains unabsorbed by calcium chloride at different temperatures. Sulphuric acid leaves approximately ½ milligram of moisture in 100 liters of air Morley finds that the proportion of moisture not absorbed by phosphorous pentoxide is only ¼ milligram in 1,000 liters of gas.

Cleaning Platinum Dishes. — Dr. P. Vieth states that the loss in weight of platinum dishes is due mainly to the methods of cleansing them. Using a large number in milk analysis, he recommends that they be treated with hot sodic carbonate solution and kept heated for about a half-hour; this is thrown away and the method repeated, using a bass-brush (a soft fibre made from some kind of a sedge), then hot water, and wiping dry with a duster. No substance should be used like sand, emery, or similar material.

Method for Generating Pure Non-arseniferous Sulphuretted Hydrogen. — Clemens Winckler takes 100 parts heavy spar, 25 parts of coal-dust, and 20 parts of common salt. The two former ingredients are finely ground, the salt is added, and the whole made up with a little water into a ball, which is rammed into a crucible of 25 centimeters in height and 10 centimeters in width. When dry, some coarse coal is laid above the mass, the lid is put on, luted down, except a small vent-hole, and heated for some hours to incipient white-ness. The heat is then allowed to go down, the crucible taken out of the furnace and let cool quickly. The barium sulphide must be preserved in stoppered bottles in a dry place. With dilute hydrochloric acid it yields a very regular current of sulphuretted hydrogen, free from arsenic.

Rapid Filtration. — Precipitates which clog an ordinary filter may be drained and washed, even without the aid of a filter pump, by means of a simple expedient described by A. B. Clemence (*Journ. Anal. Chem.*). Cut off the apex of a filter, folded in the ordinary manner, leaving an opening one-eighth inch in diameter. Close this opening with a wad of absorbent cotton, pressed down while wet, or drawn into its place by suction with the mouth. The ash in a portion of the cotton may be ascertained beforehand for fine quantitative work, but this should be very small.

A Glycerine Reaction. — A pharmacist at Hatten, named Merkling, has discovered what he supposes to be a characteristic reaction for glycerine. A borax pearl, he says, moistened with glycerine or with a small quantity of glycerine solution, and then heated in the blowpipe flame, colors the flame green. This reaction will, he assures us, enable the operator to detect as little as one per cent of glycerine in a watery solution.

Paper for Cleaning Lenses. — Professor Simon Gage of Cornell University strongly recommends the Japanese paper napkins for wiping and cleaning lenses. Professor Gage says, "I used, prior to the Japanese paper, the 'silver tissue' used by jewellers for wrapping fine jewelry, silverware, etc. Both papers are entirely free from kaolin and other material likely to scratch or injure lenses; and as they can be had at 'next to nothing,' a fresh piece can always be used, thus avoiding the dust of the atmosphere which settles on every thing exposed, even for a few minutes, in large cities."

Improved Automatic Valve for Flasks. — A correspondent of the *Chemical News* describes a new form of valve for automatically sealing the mouth of flasks, as follows: "Having often been annoyed by the frequency with which the valve made of india-rubber tubing — generally used when performing analyses by reduction — gets out of order, and will not act, I was led to make use of a modification, the nature of which is explained in a few words: Instead of the piece of tubing with a slit in it, I make a glass bulb, the size of which varies with that of the flask in use, and over this bulb I slip a small piece of india-rubber tubing sufficient to cover the bulb completely. The shank of the bulb should be about three centimeters long, and should be dropped into the neck of the flask, so that the globular portion rests on the top. When ebullition has entirely ceased, and the flame is removed from under the flask, the partial vacuum caused by the rapidly cooled gases inside draws the bulb tightly down on the flask neck, thus making a perfectly air-tight stopper, which requires considerable force to remove."

INDUSTRIAL MEMORANDA.

Prepared Mortar. — In Berlin and other large cities in Germany, mortar is manufactured in large quantities, and sold to builders by the barrel.

A Useful Magnet. — At the great steel-works in Cleveland a large electro-magnet is used, suspended from a crane, to pick up iron or steel bars and billets. It will take up eight hundred pounds, and, as soon as the electric current is turned off after moving, drop it in the proper place, thus doing the work of a gang of men.

The Power of Niagara. — Professor Ayrton has calculated that $200,000,000 worth of force is wasted annually at Niagara Falls, — wasted in the sense of not being used. He says, "If we take as a low estimate that a large, well-made steam-engine burns only 2 pounds of coal per horse-power per hour, the coal consumption which would be equivalent to the waste of power at Niagara would exceed 150,000,000 tons per annum, which, at only $1 25 or $1.50 per ton, means some $200,000,000 wasted."

The Compressed Carbonic-Acid Gas Industry in Germany, in consequence of the running-out of the patent rights two years ago, is now worked in ten factories, instead of in two, as formerly. The Berlin Limited Company, the first of the kind, which has also works on the Rhine, has an annual sale of about 500,000 kilometers. Of the compressed gas, about 70,000 kilometers are used in Berlin daily. The price, with the increased competition, has fallen from $4 00 for an 8-kilometer bottle, to $1.25.

The English Fast Train Record. — During the recent railway racing to Edinburgh and Glasgow the North-eastern Company made no change in their engines. The regular engines that had been on the Scotch service were used all the time, and in nearly all cases these were compound engines. They had a pretty heavy train throughout, and well filled with passengers and luggage. On the last day of the accelerated running they ran into Edinburgh thirty-four minutes before time. The run was done from Newcastle to Edinburgh, 125 miles, in 128 minutes by compound engine No. 117. This is at the rate of 58.6 miles for the whole run, and beats the record.

The Highest Chimney in the United States. — The chimney which has just been completed for the Clark Thread Company, at Newark, N. J., is the highest chimney in the United States, and one of the highest in the world. Three higher stacks are cited as existing in Scotland, but they were built for carrying off noxious fumes from chemical works, and not for creating a draft for steam-boiler furnaces. These chimneys are Townsend's, at Port Dundas, Glasgow, which is 454 feet high; Saint Rollox, at Glasgow, 436½ feet high; and Dobson & Barlow's, at Bolton, 367 feet high. The Clark chimney is 335 feet high, and supplies draught for 32 boilers, having an aggregate capacity of 4,000-horse power. The cost of the chimney is said to have been $35,000.

To Cool a Hot Journal. — Quite an ingenious way of cooling a journal that cannot be stopped is to hang a short endless belt on the shaft next to the box, and let the lower part of it run in cold water. The turning of the shaft carries the belt slowly around, bringing fresh cold water continually in contact with the heated shaft, and without spilling or spattering a drop of the water.

Iodide of Mercury in Tanning. — The addition of a small quantity of iodide of mercury to skins is found to effectually prevent fermentation setting in, and at the same time to produce no injurious effects in the subsequent tanning operations. It is said that the mercury salt acts as a preservative of the constituents of the tannin liquors, and that leather produced from skins that have been previously treated in this manner is superior to that tanned in the ordinary way. Messrs. Collin & Benoist, the French chemists, who have experimented with this anti-ferment, state that it completely prevents the liquefaction of the gelatine which takes place in putrefying hides, and thus saves them from this loss. A saving is also effected by its use in the prevention of the decomposition of the tannin in the tanning liquid, which is usually hastened by the introduction of the hides when in a state of decomposition. The amount of iodide of mercury required is so small, that there is no possible danger from poisoning, either to the workmen or to those subsequently using the leather, in its use.

Home, Farm, and Garden.

THE CHEMISTRY OF BREAD-MAKING.

The transformation of the flour, obtained by grinding wheat, into a soft, spongy, nutritious mass known as bread, although a matter of every-day occurrence, is dependent upon some very peculiar and important chemical changes. If flour is mixed with water to form a dough, and dried at the temperature of the air, an unpleasant-tasting mass is obtained, which contains the starch of the flour in an unaltered and insoluble state, and very difficult of digestion; and to obtain a nutritious and palatable bread, it is necessary to induce certain chemical and physical changes in the flour.

Wheat flour is principally composed of starch, and contains, on an average, about sixty-three per cent of that substance, with fifteen per cent of water. The remainder is made up of small amounts of sugar, fat, casein, and a mixture of various gummy bodies, generally known as gluten. This gluten is an important part of the flour, giving it consistency and flavor, and also rendering it more nutritious. By kneading flour under a gentle stream of water, the starch can be washed away and the gluten separated.

The action of the heat in baking causes certain changes to take place in the starch, by which it is rendered soluble, and to some extent converted into another substance resembling gum, and known as dextrine. The outside of the loaf is altered to a greater extent, forming the crust. These changes have the effect of rendering the bread both nutritious and palatable; but to prevent its becoming a heavy, solid mass of dried dough, it must be "raised," or inflated with gas, so as to convert it into a light, spongy substance which can be easily masticated and digested.

The gas used for this purpose is always carbonic dioxide, and the best method to develop it in the mass of dough is to set up a vinous or alcoholic fermentation by the addition of yeast. This substance is a most remarkable living organism, which, when introduced into the dough, begins to feed upon the starch, which it changes into alcohol and carbonic-acid gas. Owing to the tenacious nature of the dough, the gas cannot escape, but, as it expands, renders it spongy and light. The heat of the baking-oven still further expands the gas, and completes the process, at the same time killing the yeast, and preventing further fermentation. If the fermentation continues too long, it passes over into the acetic variety, the alcohol is changed to vinegar, and the bread "sours."

The alcohol produced in the process is nearly all dissipated in the baking; but it is an appreciable quantity, and some years ago a company was formed in England to introduce appliances for condensing and saving it. The method was found impracticable, but it created considerable excitement, and one baker advertised to sell his bread "with all the gin in it."

When baking-powder is used as a leavening agent, carbonic-acid gas is formed in the dough as with yeast, only it is set free by the reaction of certain chemicals upon each other, forming salts which remain in the bread, and none of the constituents of the flour are decomposed. A process has also been tried of kneading the dough in closed vessels with water containing carbonic-acid gas in solution under pressure, like soda-water; the supposition being, that when the pressure was removed, the gas would expand, and cause the dough to rise. This aerated bread, as it was called, has been made both in this country and England; but the method has not been successful, and it is not now in use.

It is interesting to note that the style of oven and method of bread-baking in use in Europe at present has undergone little or no change since the earliest times. The old-fashioned brick oven is still used, and the fire built inside until the necessary heat is obtained, when it is raked out, and the loaves put in its place. Although the method is a clumsy and wasteful one, it must be confessed that the bread produced by the French and German, and especially the Viennese, bakers, is unexceptionable in quality. Probably the care used in mixing and kneading has as much to do with the result as the baking itself.

Bread is not often adulterated, but the deficiencies of a poor flour are sometimes covered up by the addition of alum or a minute quantity of sulphate of copper (blue vitriol). These substances render the bread whiter and of a better consistency, but are not only a fraud upon the purse of the consumer, but detrimental to his health as well. Most of the cheaper varieties of baking-powder contain alum, and their use cannot be recommended.

The art of bread-making has been known from the earliest times, and as early as the period of the Jewish exodus the process of leavening was in general use. In the museum at Naples there are exhibited loaves of bread taken from a shop at Pompeii and stamped with the name of the baker. They are perfect in shape, but are quite black, probably from the heat of the volcanic ashes which were cast upon the city from Vesuvius. When properly made, bread is a most wholesome and nutritious food, and, with the other cereal products, forms the principal means of sustenance of a large majority of the human race.

THE MANDRAKE.

The mandrake (*Atropa mandragora*) is a plant which has, from ancient times, been celebrated for the resemblance of its root to the human figure. Pythagoras called it the *anthropomorphon*, or plant of human form, and in some countries it is known as the "man-faced tree." The plant possesses dangerous narcotic properties, and was an ingredient of the poisonous philters and potions of the sorcerers and magicians of the Middle Ages.

The mandrake has a bifurcated, hairy root, which, with a little alteration, can be transformed into a very good representation of a man, as shown in the accompanying illustration (from the *Magasin Pittoresque*). This accidental resemblance gave rise to the most absurd superstitions. It was said, that, when the root was pulled from the ground, it gave forth terrible shrieks and groans, which turned to stone any one who heard them. To avoid this unpleasant consequence, it was customary to tie a hungry dog to the plant, and, having thrown a piece of meat before him, to run quickly away, and out of earshot of the botanical lamentations. The dog, in his struggles to reach the food, would uproot the much-prized plant, and, it is fair to suppose, was at once transformed into a canine petrifaction; but, as no specimens have ever been preserved,

the fate of the unhappy animal must be considered as doubtful.

The mandrake is a European plant; but in this country the *Podophyllum*, or May-apple, is sometimes called by that name. It belongs, however, to an entirely distinct family.

A NEW METHOD OF POTATO CULTURE.

The old-fashioned method of planting potatoes in hills bids fair to be superseded by the "trench method" introduced the past season by the *Rural New-Yorker*. It is claimed that the yield is largely increased, the bad effects of drought are prevented, and the tubers are larger and better developed. The following description of the method is taken from the columns of our contemporary: —

The seed potatoes were spread out singly in a warm room. The eyes of the "seed end" soon pushed, forming short, warty shoots. The eyes of the other portions of the potatoes grew but slightly. The object of placing the seed potatoes in a warm, light room was to secure the most vigorous "seed" for the contest plot. All potatoes the eyes of which seemed dormant or feeble were rejected. They were cut according to the number of strong eyes developed, the object being to have at least three to a piece. On April 18 the trenches were dug with a spade about seven inches deep and a full foot in width. As we have not as yet determined whether it is better to strew the fertilizer *under* or *over* the seed, it was sown both under and over. Eight hundred and eighty pounds were first evenly sown in the bottom of the trench, and incorporated with the soil. On this, an inch or so of soil was raked, and the seed-pieces

were placed exactly one foot apart, the trenches being three feet, measuring from the middle of each. These were covered with another inch of soil, and powdered sulphur was scattered upon it at the rate of 400 pounds to the acre. Then an additional spread of fertilizer, at the rate of 880 pounds to the acre, was given, making in all 1,760 pounds to the acre. The trenches were then refilled with the soil taken out, which, being somewhat lighter than the rest, left the soil of the trenches higher than that between.

We are careful not to *compact* the trench soil any more than can be helped. The ridge left soon settles to the general level, and is so preserved during the season, as all hilling up is carefully avoided. The plot was planted to the following varieties, all seedlings of the *Rural New-Yorker*: —

No. 2 . . . . 33 pieces — one trench.
No. 3 . . . . 66 " — two trenches.
No. 4 . . . . 66 " — " "

Making, in all, 165 pieces, which, being placed one by three feet apart, made just one-eighty-eighth of an acre.

The result of this experiment was certainly quite remarkable. The yield from seedling No. 2 was at the rate of 1,076 bushels to the acre. No. 4 gave 644 bushels to the acre, while No. 3, on account of the plants being nearly destroyed by the flea-beetle, gave only 276 bushels to the acre of imperfect potatoes. The attempt to raise over 700 bushels of potatoes to the acre is to be renewed next year, and the result will be looked for with interest.

How much of this extraordinary yield is due to the "trench method" of cultivation, and how much to the special attention and extra fertilization given to the experimental crop, is uncertain; but we think it has been clearly shown that the new system is a great improvement on the old one, and we commend it to the attention of agriculturists. The *Rural New-Yorker* publishes numerous letters from correspondents who have raised potatoes the past season by the new method, and all agree that it is an advantageous one.

HOW TO TELL A HORSE'S AGE.

The foal is born with twelve grinders. When four front teeth have made their appearance, the colt is twelve days old; and when the next four assert themselves, its age will be about twenty-eight days. The corner teeth make their appearance when the foal is eight months, and these latter attain the height of the front teeth at the age of a year. The two-year old has the kernel (the dark substance in the middle of the tooth's crown) ground out of all the front teeth. In the third year the middle front teeth are being shifted; and when three years old, those are substituted by the permanent or horse teeth, which are larger and more yellow than their predecessors. The next four teeth are shifted in the fourth year, and the corner teeth in the fifth, giving place to the permanent nipper.

At five years of age a horse has forty teeth, of which twenty-four are grinders far back in the jaw, with which we have little to do. But, be it remembered, horses invariably have tushes, which mares very rarely do. Before the age of six is arrived at, the tush is full-grown, and has a slight groove on its internal surface (which generally disappears with age, the tush itself becoming more rounded and blunt); and at six the kernel or mark is worn out of the middle front teeth. There will still be a difference of color in the centre of the tooth.

The tushes have now attained their full growth, being nearly or quite an inch in length; convex without, concave within, tending to a point, and the extremity somewhat curved. Now, or perhaps some months before, the horse may be said to have a perfect mouth.

At seven years, the mark, as described, is very nearly worn out of the four centre nippers, and fast wearing away in the corner teeth, especially in mares; but the black mark still remains in the centre of the tooth, and is not completely filled up until the animal is eight years old. As he gets on past seven, the bridle teeth begin to wear away.

At eight the kernel has entirely disappeared from all the lower nippers, and begins to decrease in the middle nippers. It is now said to be "past mark of mouth."

When more than seven, the knowing ones are accustomed to go by appearances of the upper fronts, from which some conclusions may certainly be drawn, as the marks remain in them long after they have been lost from the bottom ones. Much reliance can never be placed on the tushes, for sometimes they may be found quite blunt at eight, and as often remain pointed at eighteen; and sometimes those in the same mouth will show an apparent difference of a year or more.

There are indications which enable very shrewd observers to guess at a horse's age after eight years even, but none to enable accurate determination In the ninth year the mark has entirely disappeared from the upper middle teeth, and the hook on the corner only has increased in proportion as the bridle teeth lose their points. At eight the upper surfaces of the nippers are all oval; and as the animals get older, they diminish in width but not in thickness; they become more rounded, and appear wider apart.

At twelve years of age the crown of all the lower front teeth has become somewhat triangular, and the bridle teeth much worn down; but any thing further must be left to experts, and would serve no useful purpose to enlarge upon here. We must not, however, omit to mention the fact, that, as horses advance in age, their gums shrink away, conveying that long, narrow appearance of the teeth which has long formed the subject of a proverb. They likewise lose their upright appearance, and appear to lean forward, more particularly the upper ones, which assume an arched shape.

Beyond the indications of age afforded by the teeth, are some others, which very little experience will render familiar. A dark-colored horse, as a brown or a bay, will in time turn gray about the face, mane, and top of the tail. The back becomes hollow, and the pit or cavity about the eyes gets, by degrees, more and more pronounced. — *Dublin Farmers' Gazette.*

SOME IMMENSE CAKES.

The Germans have always been great adepts in the baking of cakes, and various achievements on this gastronomic field have attained some historic renown. When the Emperor Maximilian was crowned in Frankfort-on-the-Main, in the year 1562, there was (as the chronicles of that town inform us) erected on the Roemerberg (the place before the Roemer, the great civic building or town-hall) a shed made entirely of cakes, in which a whole ox was roasted. This ox was fastened to a wooden spit by the head and feet; and it was filled inside with all sorts of animals, such as a pig, a sheep, a deer, some sucking pigs, partridges, peacocks, little birds, geese, ducks, hens, and sausages. The roasting of this ox commenced on Sunday before the coronation, and lasted till the Monday in the week following, and the shed from cakes was erected round it. The people stormed the shed, and demolished it, and every one wanted to get something of the cake and the roasted ox: but hardly one out of twenty could get a piece, and those who had the good fortune to carry off something were not able to keep it, — there were always ten at hand who wanted to divide with him; and nobody was more amused than those who looked at the performance from a distance.

Augustus the Strong, elector of Saxony and king of Poland, who died in 1733, had a similar monster baked in the camp of Zeithain. Five tons of flour were imported from France, one tun of milk, a ton of butter, and a tun of yeast; forty-eight hundred eggs were used for it, and a special oven was erected for the cake which was thirty feet long and fifteen feet broad. In a solemn procession, drawn by eight horses, the harness of which was ornamented with "bretzels," the gigantic cake, covered with flowers, was drawn along. The master baker marched in front with a knife seven feet long; sixteen assistants followed with flags; carts with cooked meat and drink closed the procession; and the god Bacchus sat on a cask. Arrived before the king's tent, the procession halted. The Minister mounted the cake by means of a ladder, offered the first piece to the king, the following ones to the court lords and ladies, and the rest was speedily demolished by the soldiers, who stormed it in regular siege fashion.

GLEANINGS.

The number of hides imported into England for home consumption is estimated at nine millions per annum, which, together with the domestic hides, bring the total number to about twenty millions.

An "Inch of Rain" means a gallon of water spread over a surface of nearly two square feet, or a fall of about one hundred tons on an acre of ground.

Breton Cattle. — A North-eastern province of France, called Brittany, is the home of Breton cattle. In color they are black and white, and are small and hardy, live on scant pasturage in summer, and are supplied in winter with cheap native provender. The cows are fine milkers.

The Burning Bush. — An herbaceous perennial named *Dictamnus Fraxinella* is sometimes called the burning bush, from the fact that the volatile oil generated by its flowers will, on a fine summer's evening, ignite if a lighted match is held above the flower. It is a very simple plant to grow, and will thrive in almost any soil. Is easily raised from seed or by division.

Giant Tree in California. — An engineer of the Comstock mines reports that, while spending some time recently in the wilds of the Sierras, in Tulare County, California, he came upon an enormous tree of the sequoia species, which he believes to be the largest on the continent. The party had no rule with them, but one of them measured the giant with his rifle, which is four feet in length. He found it to be forty-four lengths of his gun in circumference, at a point above the ground as high as he could reach. The top of the tree has been broken off, but it is still of great height.

To Exterminate the Thistle. — The famous Henry Ward Beecher, preacher and fancy farmer, claimed to have solved the problem of getting rid of the Canada thistle. He said, 'The only way to exterminate the weed is to plant it for a crop, and propose to make money out of it. The worms will gnaw it, bugs will bite it, beetles will bore it, spiders will web it, birds will peck it, heat will scorch it, cold will freeze it, rains will drown it, and mildew and blight will cover it."

The Popular Science News.

BOSTON, DEC. 1, 1888.

AUSTIN P. NICHOLS, S.B. . . . . *Editor*
WILLIAM J. ROLFE, LITT.D. . . . . *Associate Editor*

At the close of another volume of *The Popular Science News*, the publishers wish to acknowledge the many kind words of encouragement and appreciation received from its readers. They are constantly endeavoring to extend the usefulness and influence of the paper, and are pleased to know that their attempts have been rewarded with some measure of success. The death of Dr. Nichols, early in the year, left a vacancy in the editorial staff which can never be completely filled; but the list of eminent scientific and professional writers who regularly contribute to its columns was never larger than at present, and will be increased during the coming year. A special feature of the January number will be a paper by Professor Frederick Le Roy Sargent, upon "Maize," or Indian corn, illustrated by original drawings. It will be completed in two parts, and will be of unusual interest. Articles of special interest, by Professors Young, Shaler, Sumner, Brinton, and others, will be published during the year. The publishers would also make mention of the bills for 1889, which will be found enclosed in the present number, and bespeak for them an early attention.

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A MATHEMATICAL reader of the *Science News* has calculated that if every subscriber should send in one new name annually, in twelve years the entire population of the United States would be entered upon our mailing list. We hardly expect to increase our list to that extent, but would suggest that every reader should at least make an attempt at the practical demonstration of the problem, and the results cannot be otherwise than gratifying to all concerned.

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THE sons of the late Alvan Clark are about to undertake a telescopic object-glass of forty inches in diameter, thus exceeding the one made for the Lick observatory by four inches of diameter. This will have a light-gathering power — one of the most important properties of an object-glass — about one-fourth greater than the Lick telescope, and its successful completion will be awaited with interest. Not the least difficult part of the work will be to obtain a piece of glass of the required size free from defects; but if this can be procured, we have little doubt that the lens will be successfully ground and finished.

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THE cause of the familiar lustre of metals, as distinguished from the vitreous lustre of glass or quartz, has been investigated by W. SPRING. He finds, that, when powders of opaque substances were submitted to great pressure, the solid produced by the compression possessed a metallic lustre; but if the powder was more or less transparent, the vitreous lustre was obtained. It would thus appear that the peculiar lustre of metals depends upon their great opacity, and not, as has been supposed by some, upon the combined reflections from two surfaces, due to the partial transparency of the metallic surface. In other words, the metallic lustre depends upon the physical condition of the substance, and not upon its chemical nature.

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THE Franklin Institute of Philadelphia offers certain medals and prizes for meritorious discoveries or inventions in the arts and sciences, which are open to every one. Full particulars can be obtained upon application to the secretary at the above address.

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IT has been suggested by HEYES that oxygen may sometimes have a quantivalence of four instead of two, as has heretofore been held. He also supposes that the haloid elements may be trivalent as well as univalent. This theory is supported by certain chemical phenomena, and allows us to write the structural formula of the hypochlorites, chlorates, and perchlorates in a way more closely resembling that of the analogous salts.

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THE quarrel between Dr. Morell Mackenzie and the German physicians of the late Emperor of Germany is a most unfortunate affair, and about equally discreditable to both parties in the controversy. It is evident that the Emperor was afflicted from the first with an incurable disease, and no method of treatment could have done more than prolong his life for a short time. Both the English and German physicians seem to have made certain mistakes, to which undue importance was given by the opposite side; but mistakes in obscure cases are almost inevitable, and we have no doubt that all concerned used their utmost knowledge and skill to preserve the life of their distinguished patient. It is to be regretted that the physicians allowed their prejudices to get the better of their judgment, and, before the Emperor was fairly buried, entered into a controversy more appropriate to a party of defeated ward politicians than a council of distinguished professional gentlemen.

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THE possibility of lead-poisoning from the use of earthenware cooking-vessels glazed with lead has recently been discussed in medical journals. We think that the danger from this cause is slight, although not to be entirely disregarded. The silicate of lead, of which the glaze is composed, is a stable salt, and not very easily decomposed. Still, it is not impossible that the continued action of weak acids, like vinegar, might dissolve out an appreciable portion of the poisonous metal. It would be a wise precaution to use only "salt-glazed" earthenware for cooking food containing vinegar, lemon-juice, or other acids. A sensational journal has recently been warning people against the use of water-goblets of flint glass, which contains a large proportion of lead, but there is no danger at all from such a source.

[Original in *The Popular Science News.*]

ON THE ULTIMATE CAUSES OF ACTION IN ANIMALS.

BY PROFESSOR JAMES STOLLER.

ONE of the broad generalizations of modern biological science is, that the cell is the unit of living bodies. In lifeless bodies the structural unit is the molecule, or, indeed, the atom itself, if the bodies be simple substances, like iron, sulphur, etc. But, while living bodies have a molecular structure, the molecule is not their true unit of composition. The microscope shows that the tissues of living organisms always consist of elementary parts of definite physical proportions, called cells. These cells are the true units of the living body.

The cell is not merely the unit of structure: it is the functional unit as well. It is not only the anatomical element, but also the physiological element. It is not only true that the living body consists in structure of an aggregation of form-elements, but also that it consists in its functions of an aggregation of action-elements. Thus it is that any action of a living body, no matter how complex it may be, is only the result of the combined action of the cells that compose the part of the body in use. The beating of the heart, for example, is the result of the combined and co-ordinated action of the muscle-cells which compose the heart, and the origin of an idea in the mind is based upon a like combined and co-ordinated action of the nerve-cells of the brain. Thus, the cells of any organ act in harmony to attain a common end, this end being the function of the organ.

But, while the cells act in harmony, they have yet a complete independence in all that relates to their individual existence. Each cell has a life which is entirely apart from the life of all the other cells of the body. Each cell as a living entity runs its own course of existence: it has its birth, growth, maturity, and decay. It takes its own food, repairs its own waste, moves itself, changes its form, and it may even reproduce itself. In short, it performs all the essential functions which the body, of which the cell is a single minute element, performs in its larger existence.

If it be difficult to reconcile the individuality of the single cell with the evident intimate association and interdependence of all the cells in order to form the oneness of the living body, this difficulty disappears when it is understood that the relation of the cells to one another is precisely the same as that of the relation of living bodies themselves to one another. The individuality of each living body is restricted to carrying on its own internal bodily functions; for the general means of its subsistence it is dependent upon other living bodies surrounding it and forming with it the one organic kingdom. The interdependence of living bodies is just as great and of exactly the same nature as that of the interdependence of the cells of any one living body, and likewise the individuality of the cell is precisely the same as that of the living body. Indeed, the principle of individuality in community which applies in human society, prevails everywhere in organic nature, whether we consider the fauna and flora of a region of country or the cell-composition of a living body.

It is seen, then, that the cell is in itself an individuated living being. In the simplest physical form it exhibits the essential functions of living bodies. A minute spherule, perhaps one-five-thousandth of an inch in diameter, it yet has the same nature and shows the same fundamental phenomena as the most highly organized plant or animal. The difference between monad and mammal may be infinitely great as regards physical proportions, but as living organisms they stand on the same plane. The two essential powers of their

being are these: they are able to keep themselves alive and to keep their kind alive; in other words, to perform the functions of nutrition and reproduction.

If we study the cell, either as constituting a specific organism, as the monad, or as one of the units of a highly organized animal or plant body, it is easily seen that all its active manifestations directly relate to either one or the other of the two fundamental functions of nutrition and reproduction. But when we study the higher organisms, — a vertebrate animal or a flowering plant, — we seldom think that all their activities can also be referred to the exercise of these two functions. Take, for example, a bird, as a robin: it performs a great variety of actions, many of which seem often readily assignable to some external cause. For instance, it leaps from its perch to the ground because it has espied a crumb or worm, or it flies to a neighboring tree because it hears there the note of its mate. It would scarcely seem at first thought that these activities proceeded from the exercise of the two fundamental powers of its being, — the two powers which it possesses in common with all living organisms, including the monad. But it is clear that this is the fact: it darted at the worm because of hunger, that is, because the body must needs exercise the function of nutrition; and it flew to its mate impelled by sexual attraction, that is, because it must needs exercise the function of reproduction.

It is of exceeding interest to refer in this way the various activities of animals to their ultimate causes in the exercise of these two primary functions. It is necessary, of course, to take animals in their natural state, since in domesticated animals there is more or less enforced activity, as in the case of the horse, or activity resulting from education, as in the dog. Nevertheless, it will be found that the activities of domestic animals, even when resulting from training, are in the line of activities natural to them and springing from the exercise of the two fundamental powers. Thus, the labor done by the draught-horse is in the line of the exercise of his muscular system required for a normal operation of the function of nutrition, and manifested in the horse left in his native domain in the sportive acts of running and leaping. And the watchfulness of the dog left to guard his master's property is in line with the jealous care which the ancestral wolf shows in guarding her den.

We may return to the robin for a more perfect illustration of this principle. Take all the activities arising from the instinct of nest-making, — the gathering of materials for the nest, and the ingenious weaving of them together, — is it not clear that these activities are but phases of the exercise of the primary function of reproduction? Or take that other remarkable instinct, migration; it is equally plain that it is subservient to the function of nutrition. Indeed, we may define instinct as a mental force, having its physiological basis in inherited activities of the nerve-centres, which impels animals to carry on the two fundamental bodily functions. And this brings us to the broad fact that all the operations of the nervous system in animals, whether those that are the basis of the sensations, as seeing, smelling, etc., or those that awaken the appetites and passions, as hunger, fear, lust, etc., or those that result in definite acts of intelligence, are, from the biological point of view, merely auxiliary to the carrying-on of the two primary functions of nutrition and reproduction. To appreciate this principle, let it be remembered that the lowest animals are destitute of a nervous system, yet perfectly carry on the two functions, and that as we go upward in the animal scale, and meet with the first rudiments of a nervous organization, it has the clearest subordination to these functions. It cannot be conceived that the rudimentary eyes of the jelly-fish have any other use than to enable it in some slight degree to take better care of its body (nutrition), either by moving about more freely in search of food or by better avoiding its enemies. And, as we find in the higher animals the nervous system growing more and more complex in its structure and in its manifestations in outward actions, it is still easy to see that it remains subservient to the primary functions.

To take illustrations: the dog has a strong sense of smell or scent, the hawk has a keen eye, the cat a quick ear: these special powers of sense enable the animals to secure their prey, and thus provide for the nutrition of the body. Again, the squirrel is timid or shows fear, the bear is cross or shows anger, the sparrow is quarrelsome, showing jealousy: these passions clearly enable the animals to ward off their enemies, and save themselves from extinction; in other words, they subserve the perpetuation of the species, or reproduction. Again, the fox shows cunning, the beaver skill, the dog sagacity: these acts of intelligence relate to the welfare of the animals, either as individuals or as members of their kind; that is to say, at bottom, either to their bodily nutrition or to the reproduction of their species.

If it be true, then, that we can trace all the actions of animals to their causes in the exercise of the two fundamental powers common to all organic beings, it becomes evident, in a new light, that the cell is not only the unit, but also the type, of living bodies. It performs the functions of nutrition and reproduction; and, in the long run, this is all that any living organism does. The only difference between the high animal and the minute single-celled animalcule — between the monad and the mammal — is in the manner in which these two fundamental functions are carried on. In the monad they are carried on without the aid of parts or organs, in the mammal by the aid of a highly complex organization. Animals differ from one another, are low or high in the scale of life, according as they have a less or more highly organized body to enable them to carry on the two primary functions. They differ not at all in their essential powers, but only in the means of exercising these powers according to their varying environment. Organization, in animal bodies, may be defined as a means whereby they are able, under difficult and complex conditions, to carry on the functions of nutrition and reproduction.

And it is still to be kept in mind that the highly organized body is an aggregate of cells, each of which lives its own life, — a life which is typical of that of the body of which it forms one minute element. As a drop of water is one of an infinite number of drops which make the ocean, and as the powers of the great body of water are determined by the qualities of the single drop, the drop being both the unit and the type of the ocean, so the cell is the unit and the type of the living body.

Such a study as this shows clearly how sharply man is set off from the purely animal world about him. While, as possessing an animal body, his first necessities are those connected with the functions of nutrition and reproduction, yet above the sphere of animal activities he lives a life immeasurably higher and nobler. His best thoughts and actions are not for himself; he alone is capable of altruistic conduct.

UNION COLLEGE, SCHENECTADY, N.Y., *Nov.* 1.

AN OBSTINATE PATIENT. — "How many deaths?" asked a hospital physician. "Nine." — "Why, I ordered medicine for ten." — "Yes; but one would not take it," was the startling reply.

[Specially reported for *The Popular Science News.*]

THE BRITISH ASSOCIATION AT BATH.

BY K. B. CLAYPOLE.

THE meeting of the British Association for the Advancement of Science, recently held in Bath, was neither large nor brilliant. The city, although rich in antiquities and historic associations, offered little attraction to the holiday-making member, and the programme tempted him with but few of those names that always draw a crowd. Still, the members who did gather together found at least the average number of papers interesting and important to specialists, with perhaps more than the average of those of wider interest. But they found also that the various rooms were scattered over the town, compelling a close attendance to one section or the loss of much valuable time in going from one to another.

The proceedings began on the evening of Wednesday, Sept. 5, with the address of the president, Sir Frederick Bramwell, which brought forward in a suggestive manner the value of the "Next to Nothing," and sketched some of the various labors recently achieved by the civil engineer, especially in electricity, through attention to this infinitesimal item.

The practical development of electricity was taken up again next morning by Mr. W. H. Preece, who, in his address as president of the Mechanical Section, discussed it with a vigor and breadth of view which delighted a large and mingled audience. In the Section of Mathematics and Physics electricity was also the theme of the opening address, with the difference, however, that the theoretical was there the side of the subject chosen for consideration. In the hands of Professor G. F. Fitzgerald even this side became lucid as he explained some of the experiments by which in the present year Herby in Germany has decided the moot question of the production of electro-magnetic phenomena in favor of an intervening medium, — a medium pervading all space, and no other than the one by which light is propagated. Carrying the subject a little farther, Oliver J. Lodge followed with an important paper on "The Production of Ether Waves, and their Measurement." In this he gave an account of his endeavors to manufacture light by direct electric action, showing that, through his present inability to reduce the wave-lengths of the alternating electric current to a length small enough to affect the retina, he had as yet accomplished only the artificial production of direct electrical radiation, whose waves travelled through space with the same speed as light, and were refracted and absorbed by material substances according to the same laws.

It was not in the section-room only that one heard electricity discussed this year at Bath; the interest in it was keen and general, and was on Friday evening greatly increased when Professor Ayrton discoursed on "The Electrical Transmission of Power," and illustrated his lecture with experiments on a scale seldom if ever before attempted in public. At his touch bells rang; lamps were suddenly lighted; small cars ran on rails or suspended under them; motor power was converted into electric power; electrical power at low pressure into electrical power at high pressure, or *vice versa;* and, as an illustration both of the importance of this electrical transformation and of one of the latest developments in electrical engineering, the professor caused bars of metal to be welded on the platform, and held them up to the audience while still red and glowing.

The member with tastes of a general rather than special nature was well cared for at this Bath meeting, and one section seemed to vie with

another to attract him. Geography offered the latest results of African travel, with distinguished explorers, such as Johnson and Mackensie, to relate them; George St. Clair on "Jerusalem, Nehemiah's Wall, and the Royal Sepulchres;" and a letter from M. de Lesseps describing the work already done on the Panama Canal, the ports and points of interest upon it, with a cheerful estimate of the receipts that will repay the investor when once the canal is opened for navigation, an event that he confidently promised for 1890. Geology filled its room to overflowing with an exhibition of lime-light photographs of active volcanoes; and biology with an address from Sir John Lubbock on "The Solitary Wasps and Bees," and a report from Mr. G. B. Poulton on "Heredity in Cats," with an extra number of toes as exhibited in one particular family, young members of which were exhibited and presented to scientists, who promised to keep a careful record of their subsequent history. But it was the Section of Mechanics, with Edison's improved phonograph and the Tainter graphophone, that made the strongest appeal to public curiosity. Those who were fortunate enough to get into the hall when these instruments were explained by Col. Gourand and Mr. Henry Edmonds respectively will not soon forget the scene. The platform was crowded with eminent specialists from every section, the body of the large hall was packed, every point of vantage was taken up in the gallery, and even ladies had scaled ladders, and were standing insecurely holding on to any thing that offered support. With easy manner and in clear tones Col. Gourand described the original phonograph made by Edison ten years ago, and contrasted with it the instrument recently received. The story of his first trial of the improved phonograph and of the uses to which he put it for the amusement, instruction, and educatiou of his family, was well told; and when he said that it might even then be possible to give an illustration of the power of the instrument, the hall seemed full of suppressed excitement. The drum was made to revolve, a wide-mouthed funnel was attached to it, and presently, amid breathless silence, a sound which was at least suggestive of a cornet went through the notes of "The Last Rose of Summer." Every run, every trill, was accurately given; and when one considers that the solo had been played into the instrument in Edison's laboratory four months before, and had been repeated already two thousand times by actual couut, the success of the reproduction must be admitted, even though the tones were somewhat ghostlike. Almost before the applause had subsided, Mr. Henry Edmonds began to read his carefully prepared paper on "The Graphophone;" but so nervous was his manner, so indistinct his utterance, that, whatever may be the respective merits of the rival instruments, Edison's phonograph captured the audience by the superior manner of its presentation. Both instruments were afterwards put on exhibition for certain hours during the meetings, and were daily besieged by an eager crowd. The verdict given by those who reached them depended greatly on the hearer. Many scientific men could find no substantial improvement in the new phonograph over the old, and were inclined to think the graphophone more satisfactory than either, excepting for a burr of the machinery. Of the general members, some wept over music that seemed to others the product of an antiquated barrel-organ. A voice repeating "Mary had a little lamb" over and over again, now fast, now slow, and now on suggestion of another voice called Edison's, with a chorus from the employees in the laboratory, was to some proof positive of the present perfection of the instrument, and a promise of its future usefulness; while others asked for a few words on some subject more recondite, suggesting that nursery rhymes were no fair test.

The interdependence of the different branches of science led to many joint meetings between the sections. The rival theories of lightning-conductors championed by Mr. Preece and Professor Lodge were fully discussed in a large assembly of mechanical and mathematical specialists. The geologists met the biologists to ventilate, and if possible harmonize, conflicting theories as to the formation of coral reefs; leaving the question, however, very much as they found it. The biologists went in a body to the Chemical Section to ask for light on some of the problems presented by living bodies. These, lucidly stated by Professor Michael Foster on the zoölogical side and Mr. Thistleton Dyer on the botanical, were considered by such eminent chemists as Sir Henry Roscoe, Professors Armstrong and Schäffer, to be at present beyond their solution, though they believed they would one day attain that end, in spite of the great difficulty, that, as soon as they began to test a living unit, it ceased to live.

Though these pre-arranged discussions lacked the warmth of spontaneity, many of those that arose from time to time within the sections were marked with vigor. Seismic phenomena and the condition of the interior of the earth, for instance, stirred the geologists, and elicited from one and another facts of great interest and importance. The value of chemistry as a means of developing schoolboy intelligence was equally exciting to the chemists. Questions connected with socialism, technical education generally, and the technical education of women in particular, were fought over among the economists; many ladies entering valiantly into the fray. But no one subject was discussed with so much vivacity, such intensity of feeling, as the breathing capacity of the average woman. The subject was first brought forward when, in a subsection of biology, Professors Roy and J. G. Adams delivered their views on the physiological bearing of waist-belt and stays, defending on historic grounds the wearing of these artificial supports. All that has hitherto been said for and against this custom was said again, with no satisfactory result. Nor was a conclusion reached by further discussion in the Anthropological Section over some of the various physical measurements taken by Dr. J. G. Garson in the anthropometric laboratory last year at Manchester. As these measurements are taken from year to year, data are accumulated from which much may be hoped, and Dr. Garsou promises to bring forward results of great significance at some future meeting of the British Association.

[Specially reported for *The Popular Science News.*]

METEOROLOGY FOR OCTOBER, 1888.

TEMPERATURE.

Average Thermometer.	Lowest.	Highest.	Range.
At 7 A.M.	42.65°	32°	61°	29°
At 2 P.M.	52.84°	43°	67°	24°
At 9 P.M.	44.20°	33°	55°	22°
Whole month	46.60°	32°	67°	35°
Last eighteen Octobers	50.75°	46.60°, in 1888.	56.16°, in 1879.	9.56°

The lowest point reached by the mercury at the hour of observation was 32°, on the 11th; the highest 67°, on the 28th. The coolest day of the month averaged 38⅔°, on the 30th; the warmest 57°, on the 28th. The extremes came near meeting. The entire month was 4.15° cooler than the average of the last eighteen Octobers, and the coldest without an exception. Ten months of the year are now past, seven of which have been cooler than the average, and only three above, leaving a net average loss thus far of 1.48° daily. We seem to be having a cool year, truly. It has been cool enough for frosts on nearly one-half the mornings of the month, though not severe in my immediate locality.

SKY.

The face of the sky in 93 observations gave 46 fair, 16 cloudy, 27 overcast, and 8 rainy, with one trace of snow between observations, — a percentage of 45.2 fair. The average fair for the last eighteen Octobers has been 57.1, with extremes of 43.0, in 1882, and 73.1, in 1874. The present has been the cloudiest October, with the above exception, in eighteen years. The morning of the 17th was foggy. The last three days of the month were uniformly fair and fine, with westerly winds, a small compensation for the preceding gloom.

PRECIPITATION.

The amount of rainfall the past month was 4.31 inches, while the average amount in October the last twenty years has been 4.01, with extremes of .75 inch, in 1874, and 13.20, in 1869. Over an inch and a quarter fell on the 6th, and again on the 24th. The first trace of snow appeared on the afternoon of the 9th. The amount of precipitation since Jan. 1 has been 50 58 inches, while the average for the first ten months in twenty years has been only 38.54 inches, showing an excess thus far this year of 12.04 inches.

PRESSURE.

The average pressure the past month was 29.883 inches, with extremes of 29.38, on the 8th, and 30 34, on the 27th, — a range of .96 inch. The average for the last fifteen Octobers has been 29.994, with extremes of 29.826, in 1875, and 30.109, in 1886. There have been but two instances of so low pressure in October as the past month. The sum of daily variations was 6.23 inches, giving an average daily movement of .201 inch. This average in fifteen Octobers has been .165, with extremes of .113 and .211, the last-named being the only exception above the present. The largest daily movements were .47, on the 25th, .46, on the 30th, and .38, on the 24th. The barometric changes the last half of the month were large and quite variable, ending with high pressure.

WINDS.

The direction of the wind in 93 observations gave 16 N., 3 S., 6 E., 17 W., 8 N.E., 27 N.W., 2 S.E., and 14 S.W., an excess of 32 northerly and 42 westerly over the southerly and easterly, and indicating the average direction of the month to have been W. 37° 18′ N. The westerly winds in October have prevailed over the easterly, without an exception, for nineteen years, by an average of 33 53 observations, and the northerly over the southerly, with four exceptions, by an average of 7.74; indicating the approximate general average direction of the wind in October the last nineteen years to be W. 13° 0′ N. Comparing this with the average of the past month, we find the latter to have been 24° 18′ more northerly than usual, and evidently one cause of the unusual coolness. The relative progressive distauce travelled by the wind the past month was 52 80 uuits. and during the last nineteen Octobers 653.8 such units. — an average of 34.41; showing less opposing winds the past month than usual.

IN REVIEW.

It may be said that October has been much like the preceding month, very unusually cool, cloudy, and rainy, with low pressure and northerly winds So many extremes coming together has caused an

extreme October to follow an extreme September, and thus far, meteorologically, a gloomy autumn. May we not expect a bright November, especially after election!

D. W.

NATICK, *Nov.* 5, 1888.

[Specially computed for *The Popular Science News.*]

ASTRONOMICAL PHENOMENA FOR DECEMBER, 1888.

The Planets. — The Sun crosses the equator and winter begins on the morning of Dec. 21. The earth is in perihelion on Dec. 31. Mercury is a morning star at the beginning of the month, and rises about an hour before the Sun. It is just possible that it may then be seen. It rapidly approaches the Sun, and is at superior conjunction on Dec. 28. Venus is a prominent object in the western sky in the evening. Toward the close of the month it sets about three hours after the Sun. Mars sets at a little after 8 P.M. It is moving eastward in the constellation Capricorn. It passes perihelion on Dec. 3. It is no longer the conspicuous object it was during the spring and summer, being about three times as far away from the earth as it was at opposition in April. Jupiter is too near the Sun to be readily seen during the month. It is in conjunction, and changes from an evening to a morning star on Dec. 8. By the end of the month it rises a little more than an hour before the Sun. Saturn is getting into better position for evening observation. It rises at about 10 P.M. on Dec. 1, and at a little before 8 P.M. on Dec. 31. It is retrograding — i. e., moving westward — slowly, the whole motion being somewhat less than a degree during the month. It is in the constellation Leo, about 8° from the first-magnitude star Regulus (*Alpha* Leonis). Uranus is a morning star, rising after midnight. It is in the constellation Virgo, and during the month moves eastward about 1°. In the middle of the month it is about 3° north of Spica (*Alpha* Virginis). Neptune crosses the meridian about 11 P.M. on Dec. 1, and at about 9 P.M. on Dec. 31. It is about 5° south and a little east of the Pleiades.

The Constellations. — The positions given hold good for latitudes differing not many degrees from 40° north, and for 10, 9, and 8 P.M. for the beginning, middle, and end of the month respectively.

The head of Perseus is nearly in the zenith, the rest of the constellation being mainly to the east. Aries is high up on the meridian, south of the zenith; and Cetus is lower down. Taurus is to the left of Aries, high up on the south-east. Below Taurus is Orion, and below Orion is Canis Major, just rising in the south-east. Canis Minor has just risen in the east. Below Perseus (in the zenith) are first Auriga, then Gemini, then Cancer; the last just above the horizon, a little north of east. Leo is just rising. Ursa Major is low down in the north-east. Ursa Minor is mainly below the pole star. Draco is partly below and partly to the left. Cassiopeia has just passed the meridian between the zenith and the pole, and Cepheus is below Cassiopeia. Cygnus and Lyra are low down in the north-west. Andromeda is high up, just west of the zenith; and Pegasus is below it. Aquarius is just setting in the south-west, and Pisces lies between it and Aries.

M.

ANALYSIS OF NITROGEN CHLORIDE. — The formula resulting from the analysis of Dr. Gattermann is NCl_3. The compound may be violently exploded by the action of the sun or of the magnesium light, but it never explodes in darkness or on gloomy days.

Correspondence.

Brief communications upon subjects of scientific interest will be welcomed from any quarter. The editors do not necessarily indorse all views and statements presented by their correspondents.

ANOTHER TREE-PRUNER.

EDITORS POPULAR SCIENCE NEWS:

YOUR article in the October number on "The Oak-Pruner" (*Stenocorus putator*) is interesting to me on account of the resemblance of the operations of that intelligent insect to those of his first cousin who trims my elm and linden trees. My bug, however, prunes from the outside of the branch, while yours works from the centre.

This insect lays its eggs in the bark of small branches, inserting one egg at the base of each leaf on a twig, or at the base of each twig on a small branch. Having done this, it goes to a point below where its series of eggs is deposited, and, by a smooth and circular cut around the twig or branch, cuts it almost entirely off, leaving only a slender pedicle of wood the size of a small quill to hold the branchlet in its place. Of course, as soon as this little pedicle gets dry, the branchlet breaks off, and falls to the ground with the first high wind of autumn.

In the soft wood of the linden the cut made is nearly as smooth as if made with a knife; and when I first discovered this trespass, I supposed that some one had pruned the trees in that way.

I presume that you are familiar with this little animal, but possibly an account of it may interest you or your readers in connection with your account of the *Stenocorus putator*.

By what process of evolution or survival of the fittest did this insect arrive at the instinct or reasoning that it was necessary, for the development of its progeny, that the branch must be cut, but must be cut only partially off, so that it would fall at the right time?

G.

QUESTIONS AND ANSWERS.

LETTERS of inquiry should enclose a two-cent stamp, as well as the name and address of the writer, which will not be published.

QUESTIONS regarding the treatment of diseases cannot be answered in this column.

C. J. L., *Cleveland.* — Can a person become filled with electricity, either by being struck by lightning, or by handling a galvanic battery?

Answer. — This is a widespread error, based upon a false idea of the nature of electricity, which is not a material substance, but a condition of matter. If properly insulated, the human body can be electrically excited; but nothing passes into it, and, as soon as contact is made with the earth, the charge passes away. It is as absurd to say that a person is "filled" with electricity, as it would be to say that he is filled with heat or light.

F. J. B., *Kansas.* — I placed a crystal of chlorate of potash in a test-tube, and poured over it a few drops of sulphuric acid. A greenish gas was given off, which, when I introduced a strip of paper saturated with turpentine, exploded with terrific violence. What was the cause of it?

Answer. — The gas given off was chloric peroxide ($Cl\,O_2$), which is a powerful oxidizing body, and readily explodes when brought into contact with combustible bodies, especially such inflammable vapors as that of turpentine.

H. W., *Michigan.* — A recent number of the *News* says that gravitation "is an inherent property of matter." Is not life also such an inherent property?

Answer. — Life is a *condition* of matter, which, as far as we know, can only be induced by the action of a previously existing body, also endowed with life. Gravitation always exists, and no particle of matter can be deprived of it; while the condition of vitality is but temporary. Of the origin and true nature of life we know absolutely nothing, and our only knowledge of gravitation is, that it exists, and that we can measure the force of the phenomena which it exhibits.

LITERARY NOTES.

The Dispensatory of the United States of America. Sixteenth edition. J. B. Lippincott Company, Philadelphia, publishers. Price $7.00.

The United States Dispensatory is both familiar and indispensable to every druggist and physician in the country, and it is only necessary to say that the work of rearranging and revising the present edition has been most carefully and thoroughly performed by Professors Wood, Remington, and Sadtler. Over six hundred pages of new matter have been added; but, by omitting that which has become effete, the total number of pages has only been increased by a hundred and sixty-seven. The National Formulary is also comprised in the volume, and will be found a most convenient addition. The great activity in medical and chemical research during the past few years renders the new edition quite necessary to those who would keep up with the progress of science; and the present volume will most certainly meet every requirement in that direction.

Soaps and Candles. By James Cameron, F.I.C. P. Blakiston, Son & Co., Philadelphia. Price $2.25.

This is a most interesting little handbook, describing the technology of an important industry. The subject is thoroughly treated, and the work will be of value to students and all others interested in this branch of manufactures.

The same firm also publish *The Hygiene of the Nursery* ($1.50), by Louis Starr, M.D. It contains much valuable information for mothers and nurses; and if its recommendations were generally followed, the health and happiness of the "rising generation" would undoubtedly be greatly increased.

A Class-Book of Elementary Chemistry. By W. W. Fisher, F.C.S. Longmans, Green & Co., New York. Price $1.10.

This is a most excellent text-book of chemistry, and well suited for pupils commencing the study of the science. The elements are grouped according to the periodic law, and studied in the same order, so that the student becomes familiar with this important principle at the very beginning of his work.

The same firm also have for sale the *Analysts' Laboratory Companion*, by Alfred E. Johnson, F.C.S., which contains an extremely useful set of tables selected from those used in the actual work of the author's laboratory, which will save a great deal of time and trouble in the calculation and reduction of the results of analyses.

Microscopical Physiography of Rock-making Minerals. By H. Rosenbusch. Translated by J. P. Iddings. John Wiley & Sons, New York. Price $5.00.

This work, by a well-known microscopist, treats of the microscopical characteristics of the minerals composing the massive rocks, with full directions for preparing and mounting specimens on slides. It is written with characteristic German thoroughness, and is illustrated by numerous woodcuts and twenty-six beautiful plates of micro-photographs, which will be found invaluable for purposes of comparison.

Messrs. A. Lovell & Co. of New York have published a text-book on *Civil Government, and Studies of the Constitution*, by R. E. Clement, for the use of schools. It gives an excellent and impartial description of the powers and duties conferred by the Constitution, and can be read with profit by "children of an older growth," as well as those for whom it is particularly designed.

They also issue the *Commentaries of Julius Cæsar*, with the Latin text and English translation on opposite pages. Teachers — and perhaps pupils — will find it a great help in their studies of that celebrated soldier and writer.

Messrs. Estes & Lauriat of Boston have published a cheap paper edition (30 cents) of *Miss Parlor's New Cook-Book*. The authoress is generally acknowledged to stand at the head of her profession, and all good housekeepers will welcome the appearance of this edition.

Pamphlets, etc., received: *Altruism considered Economically*, by Charles W. Smiley (The Salem Press, Salem, Mass.); *Observations upon the Gallus Bankiva of India*, by R. W. Shufeldt, M.D.; *Treatment of Urethral Stricture by Electrolysis*, by Robert Newman, M.D.; *Transactions of the American Association of Obstetricians and Gynecologists; Is the Dentist a Specialist in Medicine?* by Dr. B. H. Catching; *The Preferable Climate for Phthisis*, by Charles Denison, M.D.; *A Key to the Families of Insects*, by N. M. Eberhart, Ph.D.; *Leaflets and Monographs of the Industrial Education Association*, New York, and the *Quarterly Report of the National Bureau of Statistics.*

Medicine and Pharmacy.

MINOR AILMENTS.

In the more common and less serious diseases, such as sea-sickness, habitual constipation, boils, and similar troubles, it sometimes seems as if the physician's art was less effective than in more important affections. Even a cold in the head can only be cured by that most successful of doctors, Time. It is useless for a physician to treat it with any thing but contempt, although some revenge themselves upon the catarrhal nuisance by calling it a coryza.

It is a curious fact, that a person afflicted with most of the minor ailments receives no sympathy from his friends, although his sufferings may be actually greater than if his condition was critical. A sea-sick person is always a source of entertainment to his companions whose stomachs are less "perniciously active;" while one who is blessed with the company of a "Job's comforter" is likely to have his physical sufferings aggravated by the facetious remarks of his associates, which he is generally in no condition to appreciate.

While such affections as we have referred to generally run a self-limited course to complete recovery, yet the consequences of a slight illness or accident may be more serious. Cases of death from sea-sickness have been reported, and a cold in the head may develop into a chronic catarrh. A grape-seed may lodge in the intestines and produce a fatal inflammation. We have known a slight wound of the tongue to prevent the mastication of solid food for several days, and lead to considerable gastric and constitutional disturbance. A few nights of wakefulness may bring a nervous, excitable person into a condition almost like insanity. But in such cases the trouble is but temporary; and when the cause, whatever it may be, is removed, recovery follows at once.

Our whole existence is dependent upon the proper action of a great number of organs and physiological processes, and the least of these cannot be disturbed without causing discomfort and illness. The function of the supra-renal capsules is so obscure, that we are unable to say what use they subserve in the animal economy; but whatever it may be, if it is interfered with by disease, serious constitutional disturbances are developed. It is by careful attention to the minor ailments and obscure and apparently unimportant symptoms, that the physician will gain the appreciation of his patients, and often save them from more serious illness by checking it at the beginning, before it reaches its full development.

[Original in *The Popular Science News.*]

CLIMATOLOGY AND HEALTH-RESORTS.

BY JOHN CROWELL, M.D.

The subject of health-resorts, with reference to a change of climate for the alleviation of certain maladies, is as old as the history of medicine. Hippocrates in his *Epidemics* says, "Change of climate is profitable in long-lasting illnesses. Classical literature abounds in references to the use of mineral waters and the advantages of sea-bathing; and sea-voyages have for centuries been recommended for those suffering from certain chronic affections. In our own day climatology has been studied with much intelligence, and the adaptation of certain conditions of altitude and temperature to the various phases of disease has been made with a good degree of scientific accuracy. In our own vast country new localities have been opened, especially upon the Pacific coast; and thousands of invalids in search of health annually flock to these places, with more or less benefit. In no department of practical medicine is more discretion demanded, on the part of the physician, than in deciding for his patient upon the wisdom of a change in climate, and in choosing for him a proper locality.

In the first place, the condition of the patient must be thoughtfully considered before advising him to leave his home for a health-resort. The stage of the disease must be carefully noted, and especially in phthisis and in the later changes of renal disease should the diagnosis be scrupulously made. How many poor victims leave home in the last stages of incurable disease, to find sure death among strangers! Hence many sanitary resorts have an undesirable reputation. The forlorn hope of receiving benefit by a change of climate has allured many a consumptive from the comforts of home, to languish amid the cheerless surroundings of immense hotels, erected to make money out of poor suffering humanity.

Another caution to be given to one who is seeking a change of climate is to consider the expense. Much discomfort is experienced from lack of funds, in the inability of securing proper care, and, above all, proper food. Unless one has an abundance of means, he had better remain at home; for the sufferings from the want of proper attendance, and nutritious, well-cooked food, more than offset any benefit to be derived from change of climate. The allurement often held out to a patient of moderate means, that light work is frequently abundant at the springs and in the orange-groves, is too often futile and deceiving. He will find that all such chances for light employment are filled, and that he will seek in vain for aid to eke out his scanty resources.

Another caution to the invalid is, not to go alone to a distant health-resort. Nothing is more forlorn and depressing than to have the consciousness that you are on a journey in search of health, with no one to share your burden or to divert the thoughts from the all-absorbing idea of invalidism. Cheerful companionship of persons who are *not* sick is very essential, especially to the subjects of melancholia or hypochondria.

What kind of diseases are benefited by climatic changes? And what localities must be sought for their alleviation or cure? A few may be mentioned with profit, as the season is upon us, when many invalids are contemplating escape from the rigors of our Northern winters.

In bronchial catarrh, without heart complications, when the expectoration is profuse, a dry, warm, equable climate must be selected, like Arizona. Thomasville, Aiken, and Augusta. When the expectoration is scanty, Bermudas, Jamaica, etc. The climatic conditions in the management of tuberculosis, according to the most advanced theories, are *purity*, *dryness*, *temperateness*, and *brightness*. In the matter of *purity*, it follows that small, close rooms, cabins of vessels, crowded towns, and proximity to marshes and other places of deposit for decaying vegetation, must be avoided, since in such instance the progress of organic combustion, either chemical, physiological, or zymotic, is indicated. *Dryness* is naturally quite as essential as purity in retarding incipient phthisis, as well as curing in the early stages. In the altitude climates of Davos and Colorado there is found to be less secretion from respiratory mucous membranes, due to less irritation of the air-passages from the dryness of the air inspired, or the decreased activity of the tuberculous agent of the lung tissue. For it is a well-known fact that invalids resist the cold better in a dry though low temperature than in a moist atmosphere.

By *temperateness of the atmosphere* is meant absence of extremes of heat and cold, and also exemption from sudden changes from a high to a low temperature. This is illustrated by the removal of persons who have lived long in tropical climates, to temperate regions in the colder season. It is therefore a nice question for the physician to decide, in order to establish a happy mean between a dry climate with a great daily range of temperature, and a moist atmosphere with a small variation in temperature. Between the two extremes lie the conditions favorable to health.

Brightness of the atmosphere bears a direct relation to dryness, and is an important element in its bearings upon the subject. According to Jourdonet's and Denison's tables, it appears that the intensity of sunshine increases directly with the altitude. This intensity is measured by the difference between the temperature in *sun* and in *shade*, represented by the following rule of Denison; viz., "one degree greater difference between temperature in sun and shade for each rise of two hundred and thirty-five feet."

When the heat is not too great, sunshine has most beneficial effects upon man. The blood circulates with greater rapidity, respiration is increased, peripheral circulation is more active to the advantage of the internal organs, which thus free themselves from stagnant blood, charged with excrementitious principles.

Light also plays a most important part; and, to quote Dr. Thaon, "Through its active rays it reddens the blood, and it cures chlorosis in the same manner as it restores the color to plants bleached in darkness."

Next to phthisis, the diseases that chiefly demand climatic changes are rheumatism and gout, and renal affections. The victim of chronic rheumatism dreads cold and dampness; and warmth, dryness, and abundance of sunshine are the climatic conditions to be sought. Aiken, Thomasville, and inland Florida present favorable localities; but seaside stations are apt to produce constipation, owing to contact with the sea-air, and are therefore to be guarded against.

In chronic interstitial nephritis and diabetes melitus, warm, dry climates in winter, and in summer dryness and medium elevation above the sea-level, are indicated as adjuncts to medicinal treatment. The psychical conditions call for special attention.

Florida resorts, Thomasville, Aiken, Southern California, Alexandria, Cairo, and Algiers are among the most desirable localities to be noted.

In conclusion, it must be again emphasized that the sanitary surroundings and appliances of hotels and "sanatoria" must be of the most approved standard of modern scientific experts.

Above all, must the water-supply be abundant and of the purest quality. It is fortunate when a sensible medical man is near at hand who can be consulted, and whose advice may be of great value. Care should be taken not to fall into the merciless hands of pretenders and quacks, whose business is to lurk about the health-resorts, and by their pretence and suavity deceive the poor victims of disease, who are too easily induced to listen to any smooth-sounding tale that promises relief.

[Original in *The Popular Science News.*]

TREATMENT OF SNAKE-BITE.

BY C. A. MAYO, PH.G.

IN the south-eastern corner of the ground floor of the National Museum at Washington is a small white door bearing the legend, "No admittance." Disregarding this admonition, and passing through the doorway, we found a winding stairway of stone leading downward between whitewashed walls, — cool and dark after the glare of the bright sunshine out of doors.

Going down the steps into the darkness almost as of night, a faint musky odor grew perceptible, and we almost fell over a figure crouching before a wall case in the darkness at foot of the stairs. The figure, rising, directed us toward a faint ray of light which had "lost its way, and through the crevice and the cleft of the dark wall was fallen and left."

As we approached the light, a curious, monotonous buzzing in a high key became audible. The sound was familiar, but I could not recall under what circumstances I had last heard it, though it produced a vague sense of discomfort. Entering a low, arched doorway, the sound grew much sharper and louder; and then it flashed across me that it was the warning of the "rattler."

The daylight, streaming downward from a skylight, fell directly upon a table at which was seated a man busily engaged in writing. On hearing a footfall he looked up, turning toward us a pale, smooth-shaven, serious face, with high, prominent forehead, and deep, searching eyes. This was E. B. Rheem, the assistant to the curator of the department of reptiles of the National Museum.

The walls of the small room were hidden by shelving, as were also those of the dark hallways through which we had passed. This shelving was filled with jars containing all manner of batrachians pickled in alcohol, — Lizards, snakes, frogs, centipeds, all sorts of slimy things that creep. Even the floor was covered with these jars, save such space as was necessary to pass to and fro.

Dr. Yarrow, the curator, was absent; but his courteous assistant, on learning that we were interested in "snake-bites," walked across the room, and threw back the green baize cover of a tall wooden box. The sharp buzzing which we had heard on coming in was suddenly renewed with increased intensity, and, looking into the box, we saw some three or four rusty-looking rattlesnakes, which, with heads erect, and forked tongues protruding, angrily resented our intrusion.

The curious horny formation upon the end of their tails was being violently agitated all the while, giving forth their peculiar warning. Very little play of the tail is required to enable them to sound this rattle. After being assured of their inability to escape, we placed one end of a cane upon the tail of one of the most wicked-looking fellows, pinning it to the ground. When two inches from the rattle, no effect was noticeable; when one and a half inches, the buzz was slightly less noisy; at half an inch it was perceptibly lower, though some rattling continued as long as any portion of the tail was free.

Turning to the jars, Mr. Rheem took off the cover of one, and with his cane raised a broad, scaly head out of the alcohol, saying, "This is a fine specimen of the Southern rattlesnake, *Crotalus adamanteus.* You will notice that they grow much larger than their Northern cousins, *Crotalus horridus.* Those in the box are the *horridus.*" Then, taking a stick on the end of which was a leathern loop, he showed how the head of the snake was caught in this loop, and thus held while a piece of absorbent cotton on the end of a stick was presented, and the snake irritated until he struck. The cotton absorbed the venom, which was removed by washing the cotton in chemically pure glycerine. This glycerine solution had a slightly greenish tinge, but had nothing about it to indicate the deadly character of the liquid, which consisted of eight drams of glycerine and one dram of the venom. A large rattler weighing three or four pounds will yield about fifteen drops of venom if he has not struck for some time previous; if, however, he is frequently worried into striking, the amount yielded correspondingly decreases.

A popular belief, that, if kept from water, snakes are not poisonous, appears to have some slight foundation, for experiments made with these snakes show, that, if kept without water for a week or two, the quantity of venom secreted was much smaller than when they had free access to water, and was also darker in color.

Although these snakes had been captive for several months, and had been offered all kinds of delicacies which are supposed to appeal to the reptilian appetite, they had never eaten any thing whatever. The results of this long fast were somewhat noticeable on one or two, whose skins were wrinkled and shrivelled as though too large for their bodies. When first captured they would strike viciously at any thing which was offered; but by familiarity with the noose they had become very difficult to ensnare, and when caught would require considerable irritation before striking; one, in fact, having become quite tame, so that it could be handled with impunity.

Dr. Yarrow has observed a fact not hitherto made note of; namely, that, in striking, the snake does not invariably use both fangs, appearing to have the power of volition in their use.

Attached to the museum is a kind of a hospital tenanted by various unhappy fowls, rabbits, etc., whose sad destiny it is to be immolated on the altar of science in the hope of discovering some antidote to the poison. One scarred old hen, the veteran of half a dozen experiments, has become so thoroughly inoculated from the experiments performed on her by injection of minute quantities of the venom, that she is able to successfully resist an injection which would be sure death to a new subject.

In carrying out a very extensive series of experiments which have just been concluded, Dr. Yarrow would first try an antidote on the subject, to ascertain if it alone had any deleterious effect. Having decided this, he ascertained by experiment the quantity of venom necessary to cause death in the particular animal to be experimented on, as a rabbit, a pigeon, or a hen. He would then inject a lethal dose of the venom into the tissue of the animal, and follow this by an injection of the particular antidote under consideration. Copious notes were then taken of the results. All possible precautions were taken to render the observations reliable, and all the various antidotes which have been proposed from time to time were thoroughly tested. Solutions of potassa and of potassium permanganate, whiskey, ammonia, tincture of euphorbia maculata, fluid extract of jaborandi, and even a "madstone," were experimented with. A very interesting series of experiments showed that the venom of the rattlesnake had no effect either on his own species, on the garter-snake, or on lizards.

Dr. Yarrow also investigated the reports of deaths from the bites of the Gila monster (*Heloderma suspectum*), and found some difficulty in obtaining any authentic case of death having occurred from the bite of this lizard, except where there were other complications which might have been a contributing cause. His own experiments showed, that, while its bite was poisonous, it was scarcely probable that it would prove fatal, save under very unfavorable conditions.

From time to time since the publication of a book called *Osservazione Intorno alle Vipera*, by Francesco Redi, at Florence, in 1664, various scientific men have studied and written on the subject; and after digesting their writings, and experimenting on the very extensive scale indicated, Dr. Yarrow formulates the following as the best method of procedure on the part of a person who has been bitten by one of the poisonous reptiles of North America : —

Keep cool ; retain your presence of mind. If the bite is upon an arm or leg, wrap a broad bandage of some unyielding texture tightly around the limb between the bite and the heart, commencing nearest the heart, about six inches from the bite, and wrapping toward the wound. A piece of shirt torn and doubled, a leather thong, several handkerchiefs knotted together, an inelastic suspender, a rope of grass, a tough piece of bark slit from a young tree, or almost any thing which can be converted into the semblance of a bandage, will answer. Fasten the bandage securely, and make several cross-cuts through the wounds inflicted by the snake's fangs, taking care to avoid cutting the veins, which will be plainly seen, being swollen and distended with the venom blood. Stroke the limb gently, up and down, below the bandage, to promote bleeding from the wounds. Burn some whiskey or paper in a wide-mouthed bottle, to expel the air, and immediately apply the mouth to the wound, when it will act as a cupping-glass. Better than this, however, suck the wound yourself, or get some friend with a sound mouth to do it for you. If the pulse weakens, take whiskey in moderate quantities. Loosen the bandage, and replace it from time to time, as, if allowed to remain too long, gangrene would result. If possible, cupping-glasses should be applied, followed by injecting into the wound a twenty per cent solution of potassium permanganate with a hypodermic syringe. The solution should be retained in the wound by compressing with the finger, and the flesh should be kneaded in order to distribute the solution. Repeat this if necessary. Take twenty minims of fluid extract of jaborandi, and repeat the dose unless copious perspiration follows. If the heart weakens rapidly, take fifteen drops of tincture of digitalis every two hours, or inhale a few drops of nitrite of amyl. Should all efforts prove unavailing, artificial respiration may be resorted to. Should no one be found courageous enough to suck the wound, and should no means of cupping be at hand, a chicken may be split open and applied while warm, or, as in India, the anus of a live chicken may be applied, a number of them being used.

The advantage of the use of alcoholic drinks lies only in their stimulating effect upon the failing circulation; and Dr. Yarrow thinks it entirely unnecessary for the patient to get drunk, thus ruthlessly shattering a most widely accepted and fascinating theory as to the proper course of treatment.

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TEETH AS CONSERVATORS OF NERVE FORCE.

BY M. J. GASTON.

ALL force must be sustained and fed ; and as Helmholtz has brought the calculations of force that has to be supplied for nervous exertion withiu our comprehension, and demonstrates how that force must be sustained, we find that such force can only be sustained by food. The work of the mind is nervous action, and is produced by exertion or waste force. Every thought is nervous exertion ;

grief is nervous exertion ; joy is nervous exertion ; low spirits are nervous exertion. Whenever despondency appears, or so-called nervous disorder, it is nothing else but the result of want of nourishment. A noted physician asserts "that nervous diseases are the consequence of continued waste of nervous action and incomplete nutrition, and require nothing but judicious dietetic treatment. All nervous disorders and so-called lunacy can be greatly affected by diet. Healthy and judicious food moulds the character and nourishes the brain."

This feeding of the body, this strengthening of the mind, is largely due to a complete and perfect "denture," a good set of teeth, the value of which may not be computed if the work of dividing and masticating the food be considered only. But to this consideration is to be added their importance in assisting articulation, in preserving the breath sweet and pure when inhaled into the lungs, in giving proper symmetry to the features. Indeed, the mouth and teeth may well be considered the most important of the facial features.

Taste, speech, song, mastication, and insalivation, also the avenue for air in inhalation and expiration, is the work performed by the mouth ; and the ill or good health of the teeth have much to do with each of these important processes.

If the natural teeth become impaired or destroyed, the dentist is called upon to magically supply the loss or to repair the waste. Owing to the vast importance to the health of the patient, to his personal comfort, and to his personal appearance, more and more importance is being attached to the study and practice of this branch of the healing art. The general tendency of the profession is toward conservatism, — in all cases to try to aid nature to repair the waste and preserve the vitality of the teeth, and to maintain their usefulness.

Teeth decay, and fillings waste ; but by capping the structure with a crown, the perishable matter may be solidified and saved where there is no inherent and incurable tendency to disease in the attachments and surroundings.

There are some eminent practitioners who make a progress to their "field of Waterloo" on some new procedures, as the spoon excavators and V-shaped cavities. In the lecture-room, at conventions, at anniversary meetings of the dental societies, in the midst of exhibitions of blowpipes, electric motors, pneumatic mallets, reversible tilting melting-cups, die-making for crown work, siphon tongue-holders, dental speculum, and rubber-dam holder with double buckle, the veteran will hold on with his hobby of spoon excavators and V-shaped cavities.

Practitioners also now implant into the jaws of their patients, where the natural tooth may have been removed for a number of years, other teeth, and have them become firmly fixed, and used as actively as the natural teeth, and with no inconvenience whatever. From observation it would seem that nature adopts the artificial tooth, and sends her repair in such a manner as to make true bone-tissue in cases of such implantation ; and the question arises, If one tooth, or three or four teeth, can be successfully planted, why may not full sets of natural teeth be implanted? There are daring innovators who are experimenting on this mode of operation, hoping for successful issue.

Where the teeth are all gone, or where they are largely decayed, an artificial plate is, however, still a necessity. To preserve the taste, gold plate — which should be twenty carats fine, that food may not oxidize the surface — is the best metal known to the trade. The rugæ of the palate can be preserved ; and as the organs of taste lie in the tongue, the rough surface being protected, the taste is not impaired.

However, it is being more fully understood that to sacrifice a healthy root when it can be saved by crowning it with porcelain or gold, and accept the constant annoyance of an artificial plate, is very unwise. For no matter how excellent the workmanship, nor how superior the material used by which the accomplished dentist shall give such expression to his artificial work that it may deceive the eye of the critic or of friendship, imitating the exact shades of the pearly teeth or their rosy setting, yet not a bonbon can be eaten or a meal enjoyed without the immediate cleansing of the artificial plate, or annoyance ensues.

It is said that teeth of ivory and wood are found in the tombs of Egypt, some of which were fastened to gold plates ; and in the mouths of embalmed mummies have been found teeth well filled with gold, and in as good condition as if the work were wrought by recent practitioners.

It is only recently, however, that the art has reached that perfection of finish which imitates nature so closely as to defy inspection, and to become so painless in its administration, that, when tears rush to the eyes of the fair patients, it is, one can assume, not from pain, but from the inability to talk back to the dentist, that there is weeping. For science has been a true benefaction to dentistry, and the old horrors attending the extraction of teeth are happily of the past. A more intimate knowledge of teeth and the nerve-cells and structure of the tooth is a source of study to learned microscopists constantly ; and, with the aid of anæsthetics, operations are rapidly becoming painless.

Iowa City, Iowa.

[Specially compiled for *The Popular Science News.*]

MONTHLY SUMMARY OF MEDICAL PROGRESS.

BY W. S. WELLS, M.D.

In the *Deutsch Med. Woch.* Dr. Lauenstine discusses operations to increase the usefulness of the thumbless hand, observing that "when the thumb is lost, the human hand is reduced to a mere claw, which is of little use either for taking large objects into its palm, or for seizing smaller objects with its finger-tips."

His attention was called to the subject by a case of extensive injury to the hand in which the fractured little finger healed with a twist toward the thumb. He operated on a sailor in the hospital who had lost the left thumb as far as the metacarpus. After severing the metacarpal bones of the index and little fingers with a chain-saw introduced through a very short incision along the dorsal surface, he bent these fingers at the first interphalangeal joint, and, forcibly rotating them toward the palm and toward each other, fixed them in this position by means of a suitable splint. Recovery followed without complications, and the index and little fingers were in such a position, that, when bent, their tips met, and the patient could hold with considerable firmness small objects between them.

The rotation of the little finger was more successful than that of the index, but this was due to the hardening of the tissues resulting from the sailor's work. A hand in which the metacarpus of the thumb was lost, would give better results, as the index finger could be better rotated.

Dr. Lauenstine thinks that this operation, by its simplicity, demands further trial. It does not suit all cases, he allows, but only those in which the subject proposes to do light work, such as tailoring, watchmaking, goldsmith's work, and especially writing.

The exploring needle, in the diagnosis of bone disease, has been used for years by Dr. A. M. Vance, particularly for determining the condition of bones entering into the anatomy of joints. Not only has no harm followed its use, but much relief. In a case of hip-joint disease he was able to determine that the femoral head was completely softened and breaking down, and the propriety of an excision was determined by the use of the exploring needle alone, as the other evidences of disease were rather slight. The needle is not likely to be forced into healthy bone; but in diseased bone not only does the needle enter without resistance, but a sense of grating and again of freedom of the needle's point is felt, and these are signs which give the surgeon reason for believing the bone to be diseased. Sometimes the first evidence of complete disintegration and the presence of pus is discovered in this way. The early diagnosis in these cases is of the utmost importance in determining treatment, particularly in hip-joint disease, since, if discovered in the early stage, we can remove dead bone, before the disease has spread so much as to contra-indicate interference. Even if an operation is not advisable, relief of pain is accomplished by the escape of confined fluids in the surrounding tissues. Dr. Vance has found the use of the exploring needle to afford much relief in inflammation of the knee-joint.

A new use for ether during anæsthesia is suggested by Dr. Hare of the University of Pennsylvania. When the breathing suddenly ceases in anæsthesia, it is customary to use cold water by slapping the patient with wet towels, and often dangerous delay occurs before the water arrives.

The ether may always be at hand. The doctor has found in many instances, both in man and the lower animals, that the free use of ether poured upon the abdomen causes so great a shock by the cold produced by its evaporation as to induce a deep inspiration, which is often followed by the normal respiratory movements.

Dr. Svonnikoff, in the *Meditsinskoe Obozrénie*, mentions a case of argyria, or silver-poisoning, following constant applications of lunar caustic to the throat.

The patient was a woman who was accustomed to apply with a brush a fifty per cent solution of nitrate of silver, herself making the application to her throat for syphilitic disease whenever the throat became painful. Not only the throat, but the chest and back, became stained a deep-gray color; and the discoloration was even more marked on the face.

Cocaine in hydrophobia has recently been used by Dr. Fubini of Palermo (*British Med. Jour.*) as a special application to the fauces, and gave marked relief to the characteristic spasms of the throat.

The man had been bitten on the hand by a mad dog six months before. Three companions, also bitten at the same time, had their wounds promptly cauterized; but the patient thought his too trifling to require attention. The spasms of the larynx and pharynx were extremely severe and painful; and the patient, though suffering from burning thirst, could not bear the sight of liquids. Dr. Fubini brushed the pharynx with a one-in-twenty solution of hydrochlorate of cocaine, with the result that the spasm almost immediately ceased, and the man was able to drink without the least difficulty.

A late issue of the *Canada Medical Record* contains an editorial on the abuse of the use of milk. It claims that the abuse consists in using milk as a beverage instead of as a food. Milk is especially contra-indicated in cases of acute rheumatism. In several cases of this disease referred to, all had

been large drinkers of milk, and their temperatures respectively were over 103, and the pain was excessively severe when they came under treatment. By putting them on a diet of thin water gruel suitably flavored, and a mixture containing ten grains of salicylate of soda, to be taken in half a tumbler of weak lemonade every two hours until relieved, in every case the symptoms had almost disappeared within thirty-six hours; and the urine, which had been dark and loaded, at the same time became clear.

DR. GEORGE M. STERNBERG says that in yellow-fever the urine and the vomited matters are highly acid. The intestinal contents also have an acid reaction. He therefore proposes an alkaline treatment, and gives the following formula: —

R. Sodii bicarb.	150 grs.
Hydrg. chlorid. corrosiv.	$\frac{3}{10}$ gr.
Aquæ puræ	1 quart.
M. Sig.	

The patient to take about one and three-quarters ounces every hour, ice-cold.

The house physician at the Garcini Hospital has sent (*Medical Record*) a report of twelve cases treated by the alkaline and bichloride method, and it appears that all of them recovered.

While these twelve cases were being treated, eight cases were treated in the same institution by other methods, and five of the eight died.

DR. WOLTERING of Munster, Wurtemberg (*Allgemeine Med. Cent. Zeitung*), recommends the more extensive use of gluten bread, both on account of its extremely nutritive qualities as an article of diet, and its very low price. He claims that pure gluten bread is three times as nourishing as meat, and that bread made with the addition of forty per cent of gluten contains more albumen than hare or chicken of the best quality.

THE phonograph, as an instrument of precision in preserving voice and heart sounds, forms the subject of comment in the *New York Medical Record*. It states that Dr. William Porter of St. Louis has made some practical observations in this field. He found that not only are different voice sounds preserved distinctly, but also that, by attaching an ordinary stethoscope to the phonograph, some of the cardiac sounds could be easily recognized after they had been recorded by the new invention. The murmur of a case of mitral insufficiency was especially well reproduced.

The *Record* indulges in the following: "We may be able to buy cylinders of cardiac murmurs, aneurismal bruits, fœtal heart-sounds, etc, at "list price, twenty per cent off," just as we now buy charts, manikins, and models."

DR. BOXALL (*Medical Press*) calls attention to the incompatibility of certain antiseptics when mixed. He has ascertained that mixtures of corrosive sublimate and iodine, iodine with carbolic acid, and carbolic acid and olive-oil, produce chemical changes which materially affect the properties of the original constituents. He found, moreover, that soap and glycerine are, as a rule, bad vehicles for antiseptics. Perchloride of mercury, iodine, salicylic acid, and permanganate of potassium are changed or precipitated by admixture with soap.

DR. SALKOWSKI (*Medical Press*) writes concerning the use of chloroform for the preservation of samples of urine for analysis. A six-per-mille solution was found by him to effectively prevent the growth of micro-organisms, and he recommends it to be added to pathological liquids and for preserving anatomical specimens. He also suggests the employment of such a solution internally as a disinfectant and as a mouth-wash, and observes that it could be advantageously added to solutions for hypodermic use.

DRS. HÉNOQUE and FRIDEL, Paris, state that the extraction of a tooth may be rendered painless by spraying the neighborhood of the external ear with ether.

The anæsthesia of the trigeminus so produced extends to the dental nerves, and thus renders the production of general anæsthesia needless.

DEGENERATION OF THE HUMAN TEETH.

THE law of retardation exhibits itself in the teeth of the higher races of mankind in a highly inconvenient manner. The greatly developed brain requires all the available room in the skull; there is no space left for the attachment of muscles for a powerful jaw. Cooked food also causes a degeneracy in the development of the jaw. There is constantly no room left for either the wisdom-teeth or the second upper incisors; the wisdom-teeth are retarded, often cause great pain, and decay early. The second incisors appear in startling and unexpected places, and often (in America especially) do not cut the gum at all. Professor Cope says that "American dentists have observed that the third molar teeth (wisdom-teeth) are in natives of the United States very liable to imperfect growth or suppression, and to a degree entirely unknown among savage or even many civilized races." The same suppression has been observed in the *outer pair of superior incisors*. This is owing, not only to a reduction in the size of the arches of the jaws, but to *successively prolonged delay in the appearance of the teeth*. In the same way, men and the man-like apes have fewer teeth than the lower monkeys, and these again fewer than the insectivorous mammals to which they are most nearly allied. When this difference in dentition has been established, civilized man may claim to place himself in a new species, apart from low savages as well as from high apes. — *Popular Science Monthly*.

HUMORS.

PATENT-MEDICINE MAN (to editor of religious newspaper): "You made a nice mess of that testimonial advertisement!"

Editor: "How?"

Patent-Medicine Man: "John Smith wrote, 'Your Live-forever Pellets are doing me a great deal of good. Send me another box,' and I told you to give it a prominent place."

Editor: "I did, — immediately preceding the death-notices."

Patent-Medicine Man: "Yes, and the first death-notice on the list was that of John Smith!"

A WICKED URCHIN'S STRATEGY. — A nine-year-old Eagleville (Conn.) boy was belated at Coventry, several miles from his home, the other night, and, being afraid to go home in the dark, put his Yankee wits to work. Pretty soon a doctor of the place was informed by a small boy that a well-known citizen of Eagleville was very ill with typhoid-fever, and wanted him to come to him immediately. The doctor said he'd go after supper, and asked the lad to join him at the table. The boy did so, and soon after was snugly tucked in by the side of the doctor in his carriage, and rolling homeward. When they arrived at the house of the alleged sick man, the boy scrambled out; the doctor followed, and knocked at the door. The citizen himself, in his usual health, opened it. He hadn't been sick, and hadn't sent for the doctor. Then they looked for the boy. They couldn't find him. He had had his supper, and ride home, and was well out of the way.

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SETH C. BASSETT,

MANAGER.

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Publishers' Column.

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ERASMUS WILSON, M.D., F.R.S.

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